The NATIONAL GEOGRAPHIC MAGAZINE

Vol. XX SEPTEMBER, 1909 No. 9

CONTENTS

The Glass-bottom Boat. By Charles Frederick Holder. With 17 Illustrations.

Explorations in Crete. By Edith H. Hall. With 15 Illustrations.

The Afghan Borderland. By Ellsworth Huntington. Part I: The Russian Frontier. With 14 Illustrations.

With the Monks at Meteora: The Monasteries of Thessaly. By Elizabeth Perkins. Illustrated.

The Prehistoric Ruin of Tsankawi. By George L. Beam. With 12 Illustrations.

Hidden Perils of the Deep. By G. R. Putnam Illustrated with 22 diagrams.

The Wheeler National Monument. Illustrated.

PUBLISHED BY THE NATIONAL GEOGRAPHIC SOCIETY
HUBBARD MEMORIAL HALL
WASHINGTON, D. C.

SUBSCRIPTION, $2.50 A YEAR SINGLE NUMBER, 25 CENTS

Entered at the Post-Office at Washington, D. C., as Second-Class Mail Matter
Copyright, 1909, by National Geographic Society, Washington, D. C. All rights reserved

XUM

NATIONAL GEOGRAPHIC SOCIETY

HUBBARD MEMORIAL HALL

SIXTEENTH AND M STREETS, WASHINGTON, D. C.

WILLIS L. MOORE . . . PRESIDENT — HENRY GANNETT . . VICE-PRESIDENT

O. P. AUSTIN . . . . SECRETARY — JOHN JOY EDSON . . . TREASURER

GILBERT H. GROSVENOR . . EDITOR — F. B. EICHELBERGER . ASST. TREASURER

JOHN OLIVER LA GORCE, ASSISTANT EDITOR

BOARD OF MANAGERS

ALEXANDER GRAHAM BELL
Inventor of the telephone

C. M. CHESTER
Rear Admiral U. S. N., Formerly Supt. U. S. Naval Observatory

F. V. COVILLE
Botanist, U. S. Department of Agriculture

RUDOLPH KAUFFMANN
Managing Editor, The Evening Star

T. L. MACDONALD, M. D.

WILLIS L. MOORE
Chief U. S. Weather Bureau

S. N. D. NORTH
Formerly Director U. S. Bureau of Census

HENRY F. BLOUNT
Vice-President Am. Security and Trust Co.

O. P. AUSTIN
Chief U. S. Bureau of Statistics

CHARLES J. BELL
President American Security and Trust Co.

T. C. CHAMBERLIN
Professor of Geology, University of Chicago

GEORGE DAVIDSON
Professor of Geography, University of California

JOHN JOY EDSON
President Washington Loan & Trust Co.

DAVID FAIRCHILD
In Charge of Agricultural Explorations, Dept. of Agric.

A. J. HENRY
Professor of Meteorology, U. S. Weather Bureau

C. HART MERRIAM
Chief U. S. Biological Survey

A. W. GREELY
Arctic Explorer, Major Gen'l U. S. Army

HENRY GANNETT
Geographer of Conservation Commission

J. HOWARD GORE
Professor of Mathematics, The George Washington Univ.

GILBERT H. GROSVENOR
Editor of National Geographic Magazine

GEORGE OTIS SMITH
Director of U. S. Geological Survey

O. H. TITTMANN
Superintendent of U. S. Coast and Geodetic Survey

JOHN M. WILSON
Brigadier General U. S. Army, Formerly Chief of Engineers

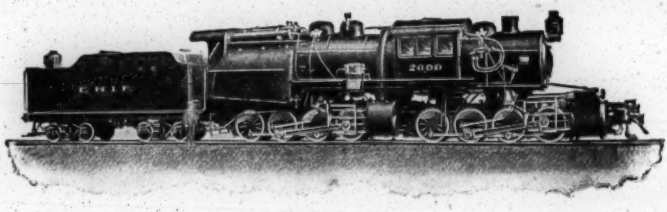
To carry out the purpose for which it was founded twenty-one years ago, namely, "the increase and diffusion of geographic knowledge," the National Geographic Society publishes this Magazine. All receipts from the publication are invested in the Magazine itself or expended directly to promote geographic knowledge and the study of geography. Articles or photographs from members of the Society, or other friends, are desired. Contributions should be accompanied by an addressed return envelope and postage, and be addressed:

GILBERT H. GROSVENOR, EDITOR

ASSOCIATE EDITORS

A. W. GREELY
C. HART MERRIAM
ROBERT HOLLISTER CHAPMAN
G. K. GILBERT
O. H. TITTMANN
ALEXANDER GRAHAM BELL
DAVID T. DAY
DAVID G. FAIRCHILD
ALEXANDER MCADIE
HUGH M. SMITH

The Hamilton Watch



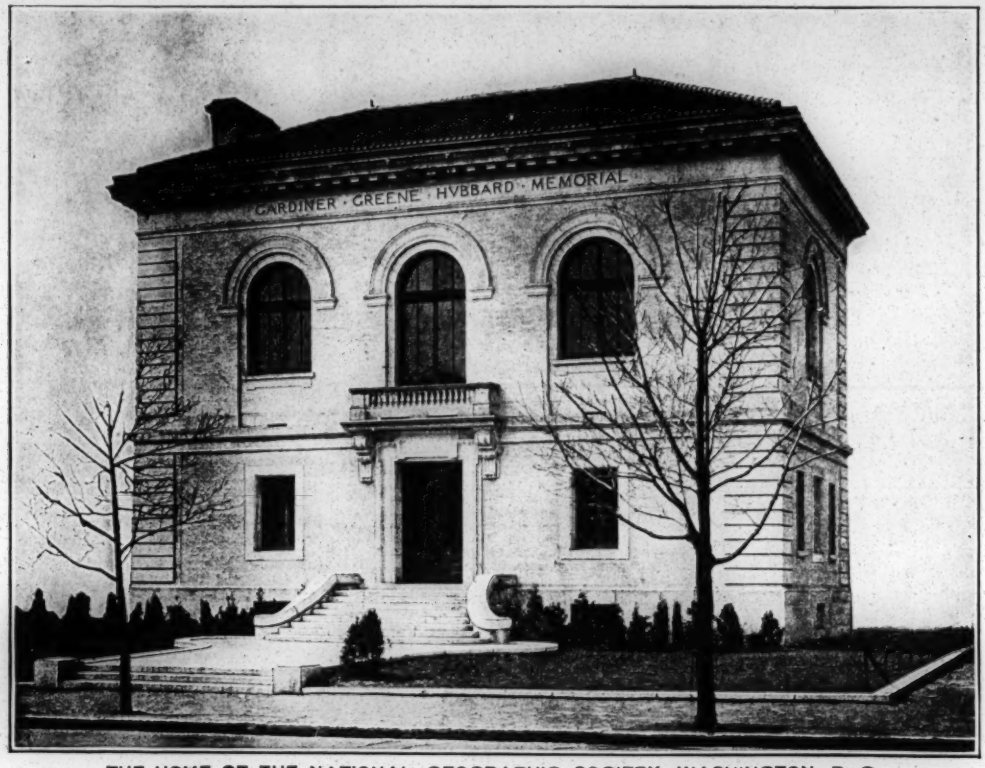
The National Railroad Timekeeper
of America

Referring to our new *"Lady Hamilton"* Watch, just now put upon the market, we quote a statement made by one of the most prominent watch men in America, and who is acknowledged to be one of the most scientific watch experts in this country, occupying a very prominent position in one of the finest jewelry stores of the West.

After seeing the "Lady Hamilton" and giving it a most exhaustive test, he said: "I had not expected to live long enough to see so fine a watch made in America."

And if you wish the highest degree of time-keeping accuracy, phenomenal durability, and the *Most Beautiful Watch* made in America, purchase the *"Lady Hamilton."*

Your courtesy in mentioning the Magazine when writing will be appreciated



THE HOME OF THE NATIONAL GEOGRAPHIC SOCIETY, WASHINGTON D. C.
An Association organized for "the increase and diffusion of geographic knowledge."

Please detach and fill in blank and send to the Secretary

Recommendation for Membership in the

NATIONAL GEOGRAPHIC SOCIETY

The membership fee includes subscription to the National Geographic Magazine

DUES: Annual membership in U. S., $2.00; annual membership abroad, $3.00; Canada, $2.50; life membership, $50. Please make remittances payable to National Geographic Society, and if at a distance remit by N. Y. draft, postal or express order.

.....1909

To the Secretary, National Geographic Society,
Washington, D. C.:

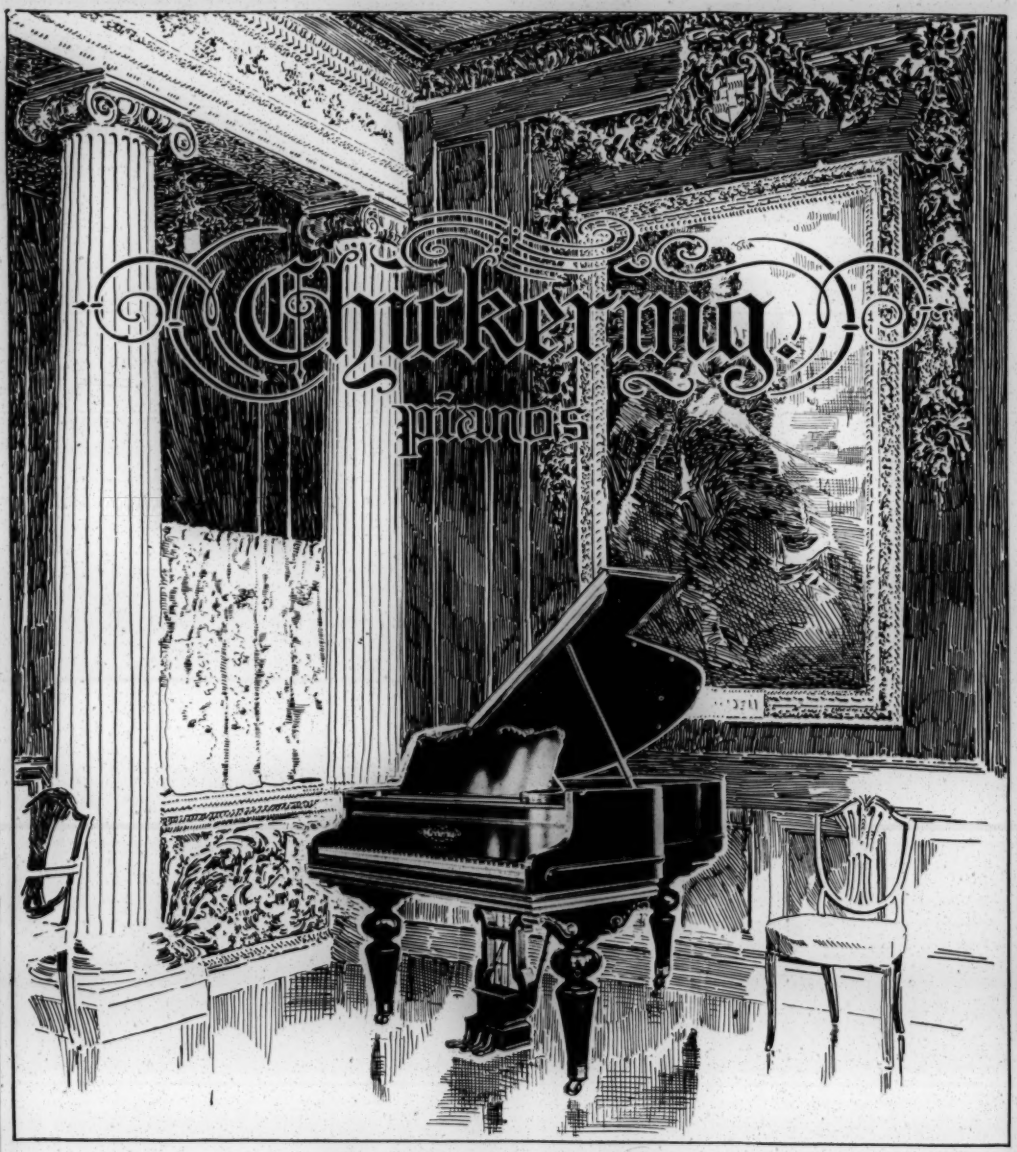
I nominate .....

Address .....

.....

for membership in the Society.

.....

.....
(Write your address.)

The Chickering Piano

has been made in Boston without interruption for eighty-six years. It has always been famous for its beauty *of* tone *and* great durability. There can be no better piano made than *The* Chickering--the best materials, the best workmanship, the largest experience are all employed in its construction. It is

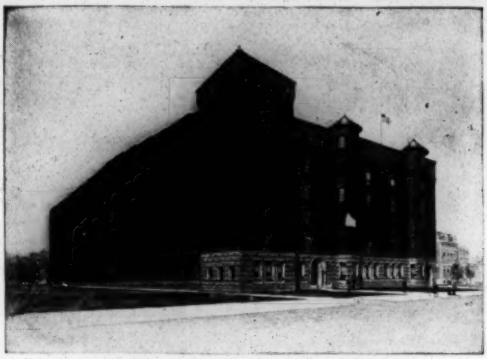
"*The* Oldest in America *and* the Best in the World."

Quarter Grand, Style R, $600. Upright, Style K, $500.

Chickering Pianos may be bought of any regular Chickering representative at Boston prices with added cost of freight and delivery. Our literature will be sent upon request.

Made Solely by CHICKERING & SONS

791 Tremont Street, Cor. Northampton Established 1823 Boston, Mass.



OUT-OF-TOWN DEPOSITS

can be shipped us by freight or express and insured during transit. Our customers are in all parts of this country and abroad.

Moth-Proof Cold Storage Rooms

Safe Deposit Vaults for Valuables

REMOVALS

We will undertake the removal of household establishments from city to city with complete attention to every detail and **insurance against breakage from any cause.** Local references given

STORAGE

Those considering the storing of household effects for periods of one or more years will find our rates of storage, combined with saving in insurance and the protection afforded from loss or deterioration, will amply offset transportation charges.

CORRESPONDENCE INVITED

Security Storage Company

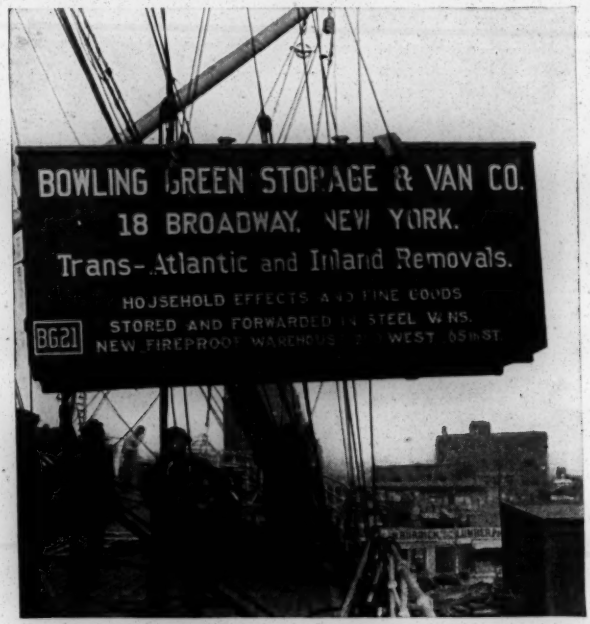
Successors to Storage Department American Security and Trust Co.

FURNITURE WAREHOUSEMEN
PACKERS, AND FORWARDING AGENTS

1140 Fifteenth St.

Send for Illustrated Descriptive Booklet and Price-List.

Washington, D. C.


BOWLING GREEN STORAGE & VAN CO.
18 BROADWAY. NEW YORK.
Trans-Atlantic and Inland Removals.
HOUSEHOLD EFFECTS AND FINE GOODS
STORED AND FORWARDED IN STEEL VANS.
B621

HOISTING LIFT-VAN ON BOARD STEAMSHIP

LIFT-VANS will be provided for prompt loading in any city of the United States or of Europe.

¶ In no other way can Household Goods be moved across the ocean, in absolute security, with despatch and economy.

BOXING NOT REQUIRED

IN WASHINGTON, APPLY TO

Security Storage Co.

1140 Fifteenth Street N.W.

BOWLING GREEN STORAGE AND VAN COMPANY

18 Broadway, New York

Cable Address: Bowlingvan, New York

Codes: A B C, Fifth Edition, Lieber's Code

VOL. XX, No. 9 WASHINGTON SEPTEMBER, 1909

THE NATIONAL GEOGRAPHIC MAGAZINE

THE GLASS-BOTTOM BOAT

BY CHARLES FREDERICK HOLDER

AUTHOR OF "BIG GAME FISHES," "LIFE OF CHARLES DARWIN," ETC.

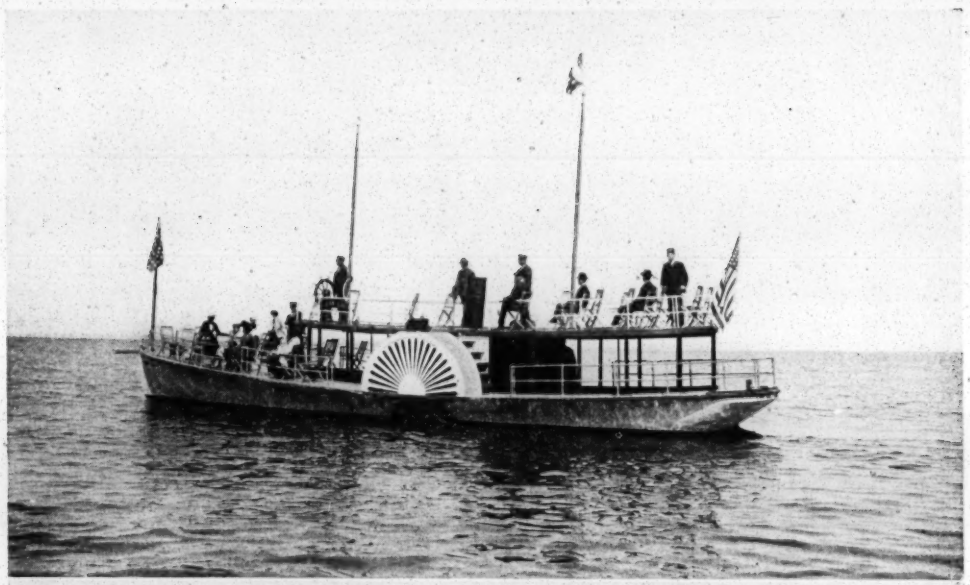
THE old tar who described his ship to a landsman as having three decks and no bottom would doubtless be surprised to see how near modern invention has copied his description, as the glass-bottom boat in its evolution has two or three decks and almost no bottom, in place of which are great panes of glass or windows, down through which the bold navigator looks and sees the wonders of the sea.

Many years ago I used a glass-bottom box on the Florida reef for collecting rare corals, and when something was seen in fifteen or twenty feet of water we dived down and brought it up. In this way I had delightful experiences and came in a few years to know the great reef about Garden Key like a book, all from these submarine excursions, soon being able to remain under water a minute, a short time compared to the Japanese or Hawaiian divers.

When I first visited the channel islands of southern California, some twenty years ago, I was impressed with the beauty of the kelp beds and the marine fauna, and had a glass-bottom box made and also planned a glass-bottom boat. From this, and doubtless the suggestions of others as well, has grown an extraordinary avocation, that of the glass-bottom boat. The capital invested in all probability is nearly $100,000 and the income is a good and increasing one, due to the fact that the attractive island of Santa Catalina is the Mecca for thousands of tourists annually, most of whom go out in the glass-bottom boats.

When you land in the beautiful Bay of Avalon, about thirty miles from San Pedro, the port of Los Angeles, you are met, not by hackmen, but by glass-bottom boatmen: "Here you are! Marine Jimmie's boat, only fifty cents." "Take the *Cleopatra*" or "Right away now for the Marine Gardens." And the ocean steamer is met in the bay by these strange craft, that look like the old-fashioned river side-wheelers. These boats are made on the island, and range from row-boats with glass bottoms to large side-wheel steamers valued at $3,000. There is a fleet of them, big and little, and they skim over the kelp beds, and have introduced an altogether new variety of entertainment and zoölogical study combined.

The boat is made by having the bottom to the extent of the boards beside the keel to the width of three feet from bow to stern replaced by thick plate-glass, set inside of a railing so that the glass cannot touch the bottom; even if it did, the observer looks down through a well, his



A GLASS-BOTTOM BOAT

AVALON BAY, SANTA CATALINA ISLAND

THE KELP BEDS AS SEEN THROUGH THE GLASS-BOTTOM BOAT, SHOWING THE VINES AND HALIOTIS SHELLS

SCENE THROUGH THE GLASS-BOTTOM BOAT, SHOWING BLACK AND WHITE SEA FLOWERS

elbows comfortably resting on the padded edge. As the boat moves slowly along, every object on the bottom can be distinctly seen, as the glass magnifies it. The best view doubtless is had from the small boats, as they can go well inshore, but both have their advantages.

The small army of men or skippers each has his individuality, and while their zöology is not by the card, it is original; and as that of the average voyager is rather hazy, it makes little difference whether a sea-hare is described as an insect, as the public long ago accepted the dictum of Montgomery, the poet, that the coral animal is an insect, and all the zoölogists since have been unable to change their opinion. The object lesson of the trip is a very valuable one, however, and a better or more fascinating way to study marine zoölogy could not be designed, as a marvelous horde of strange and beautiful creatures are passed in review.

SURROUNDED BY A FOREST OF KELP

The submarine scenery is particularly attractive here. The entire island, nearly sixty miles around, is lined with a forest of Nereocystis, or kelp, a huge vine whose leaves rise and fold and unfold in the water, the abiding place of countless animals of all kinds. This fringe rises in deep water ten or twenty feet from the rocks, and inshore are myriad forms of algæ of various colors, to which the skippers have given fanciful names, as the Yosemite, the Grand Cañon of the Sea, the Great Divide, etc., all of which adds to the piquancy of the amusement.

The divers often follow the boats around, and for a bit will dive for haliotis shells, which doubtless they have planted, though almost every rock has its living shell. As the boat moves over the shallow water of Avalon Bay, exclamations come quick and often, as one scene melts away and another appears, and the entire range of color is exhausted before the trip is over.

The fauna of this region is particularly interesting, as many of the animals seen are peculiar to it. The accompanying illustrations are from photographs taken under the writer's supervision and show the various animals seen through the glass-bottom boat, alive and under water. Care was taken to show the natural environment as nearly as possible, and they are the first photographs of the living Pacific Coast fishes ever made, each one being the result of repeated trials and many failures. The kelp itself forms a beautiful picture, its rich olive hue when it catches the sun looking not unlike a great band of amber against the vivid torquoise of the water, as deep water is so near the shore that often one can dive into blue water from the rocks.

A common form in the weed is the giant California star-fish, its white tubercles against the pink or red surface making it a striking figure against the green, red, or purple weeds. Near it will be seen the large California sea-cucumber lying on the rocks, prone and motionless, and near by the long-spined sea-urchin, very similar to the one of the Florida reef, though not so long. With it is a small, pure white sea-urchin from deeper water, a charming contrast to the green weed that is in constant motion, waving and undulating in the waves that affect even this quiet bay.

THE HIDEOUS OCTOPUS

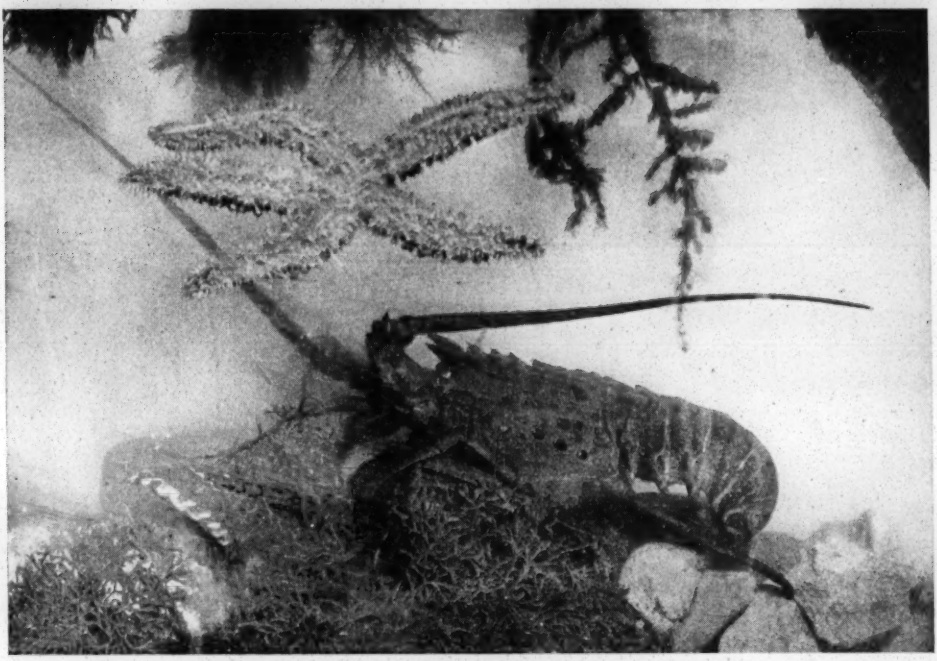
We now drift over a rocky area where the water appears to be a pale blue. A reddish-yellow crawfish waves its serrated spines back and forth from a crevice, and passing before him is a hideous octopus, searching for crabs or anything that it can lay its tentacles on. This, without question, is the most fascinating animal to be seen through the glass window. Timid, constantly changing color, hideous to a degree, having a peculiarly devilish expression, it is well named the Mephistopheles of the sea, and with the bill of a parrot, the power to adapt its color to almost any rock, and to throw out a cloud of smoke or ink, it well deserves the terror it arouses. The average specimen is about two feet across, but I have seen individuals four-

GIANT CALIFORNIA STAR-FISH: SANTA CATALINA

teen feet in radial spread, and larger ones have been taken in deep water offshore. The strength of the octopus is extraordinary. Several kept in confinement by me have almost succeeded in holding my hands despite all my strength.

A relative of the octopus, the squid, is often seen here ten feet long. One kept alive by me for a while weighed two hundred pounds and was eleven feet long, presenting a marvelous flashing of colors over its body that could only be compared to chain lightning.

In the crevices of the rocks you may



CRAYFISH AND STAR-FISH

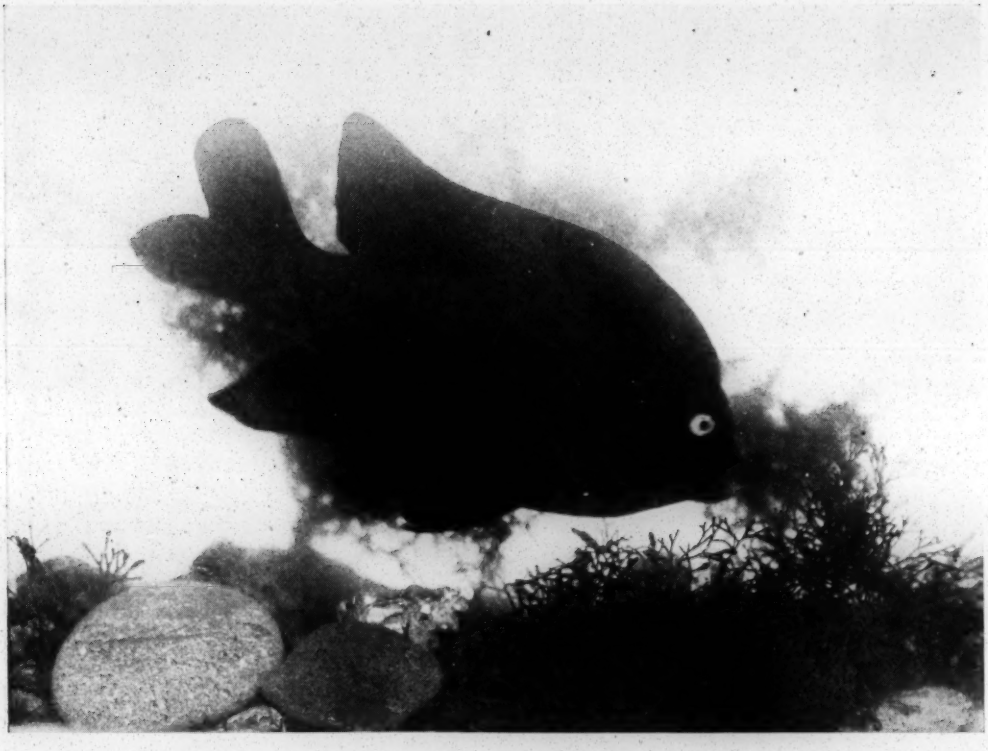
catch brilliant flashes of vivid red. This is the Garibaldi, a fish resembling the angel fish of Florida to some extent, but peculiar to this coast. It is very sociable, and comes out, eyeing the boat and doubtless familiar with the strange double row of faces that are looking down at it. The adult Garibaldis are one color, a brilliant golden red, but the young, which can be seen in the crevices, are dotted with brilliant blue, and the skipper calls them "electric fishes" and tells you the spots give out light.

PHOSPHORESCENT JELLY-FISH

Suddenly the boat passes over a white and pink jelly-fish. It is two feet across the disk, from which drifts away a wonderful fluted mass of shrimp-pink tentacles ten or fifteen feet long. Some of these jellies have been seen with tentacles from twenty to forty feet in length, a veritable comet, and at night a phosphorescent meteor.

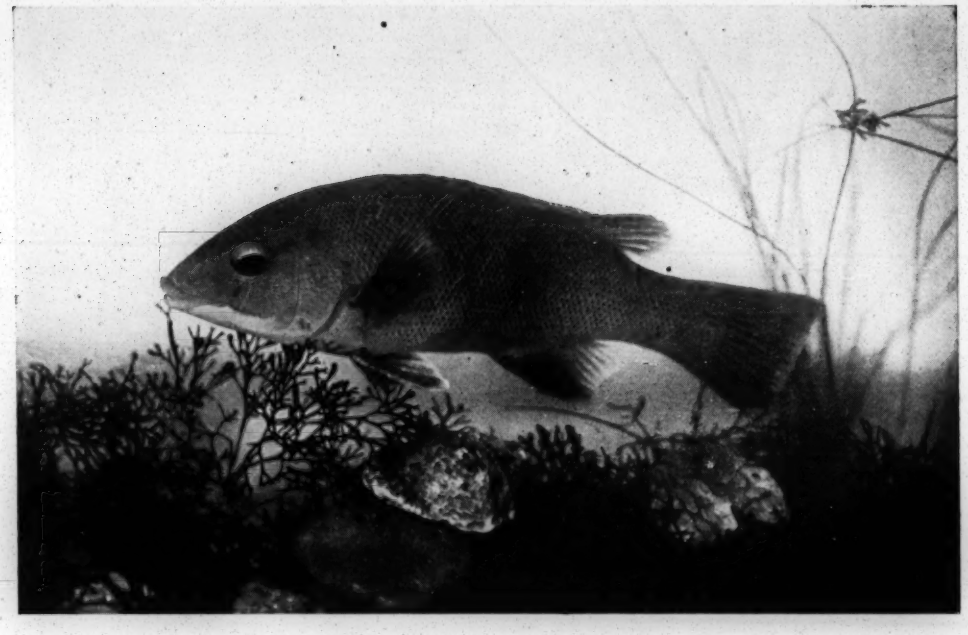
Near by is another jelly something like this, but almost black—a deep maroon in color. The skipper holds the boat over them, and every motion of the curious creature is seen as it opens and shuts and pumps its way through the clear water. Countless small jellies fill the water at times, most graceful shapes; some that have never been described, others rare elsewhere are common here. Such is the Pyrosoma, one of the luminous compound Ascidians. It is a barrel-shaped animal with one end open. Specimens six feet long have been seen. Dr. Moseley, the English naturalist, describes one which he placed on deck, writing his name on it and seeing the letters come out in lines of fire. The Bay of Avalon is sometimes filled with them, and now we see them pumping their way along beneath the window-like crystal vases, with other luminous forms, as the giant Salpa, the latter now singly, now in chains, among the most beautiful of the phosphorescent animals.

A striking fish is the sheepshead, with black and crimson bands in the male, a gray in the female, shown here. The



THE GOLDEN ANGEL FISH

BLACK JELLY-FISH, PHOTO FROM LIFE, IN THE WATER



THE FEMALE SHEEPSHEAD

young are attractive little fishes splashed with blue.

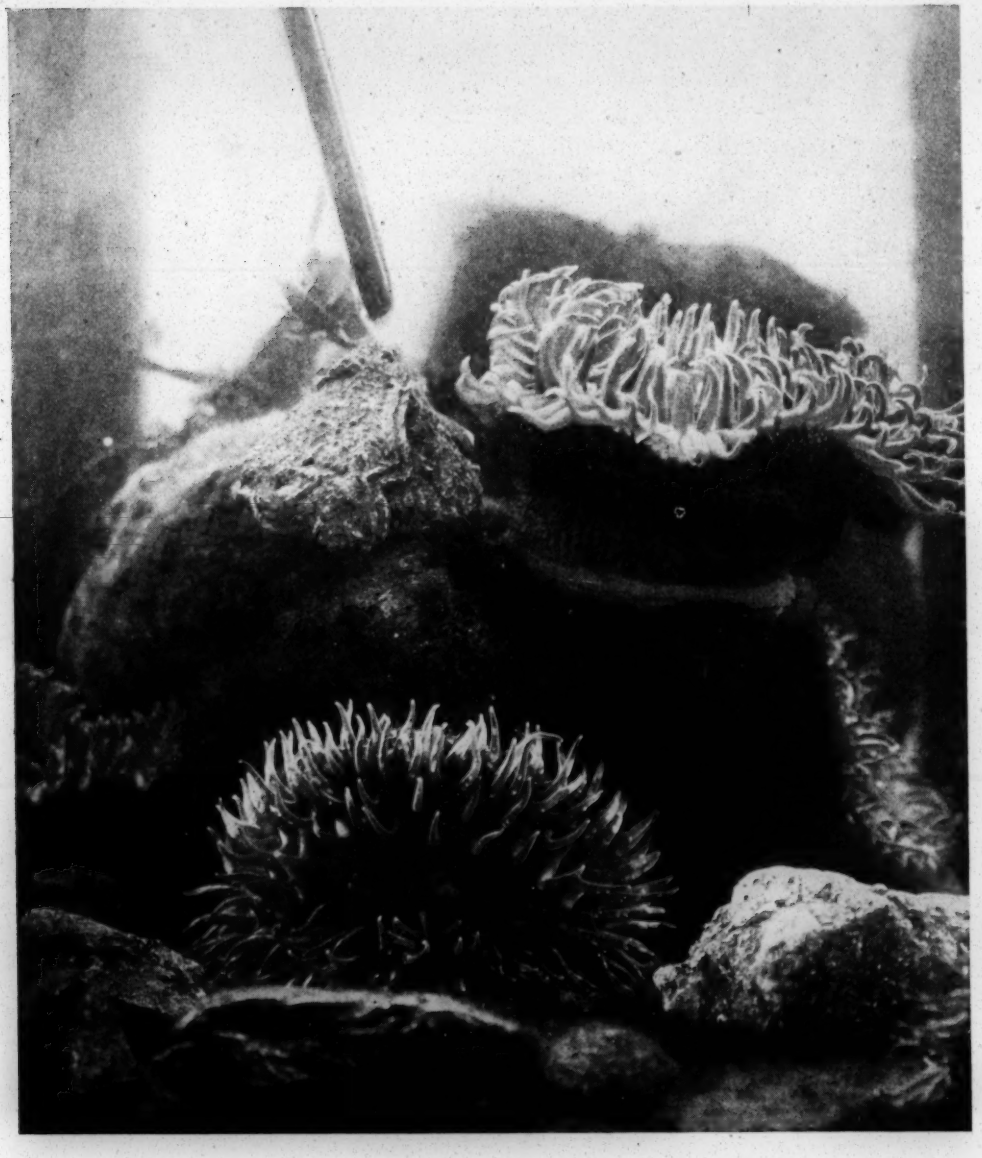
At times, after great storms, the voyager, peering down through the glass window, sees strange and weird animals new to science or so rare as not to be seen alive by one in fifty thousand. Such is the deal fish, seen lying on a weed, about three feet long, a band of purest silver; when it moves or swims it appears to undulate like a ribbon. Specimens of an allied form twenty feet long or more have been found near here. The fish lives in the deep sea, doubtless, and only at rare intervals comes to the surface to be seen or caught in the nets of the fishermen.

THE PAPER NAUTILUS AND WONDERFUL SEA ANEMONES

If we are very fortunate we shall see the paper nautilus, the most beautiful of all the mollusks, which forms a dainty capsule or shell that has for ages been a model of all the most beautiful of animal creations. If we are again fortunate we may also see the animal leave the shell and move about, flushing a pale red, now a vivid blue. This is the animal that is supposed to raise its sails and float on the seas, "a thing of beauty, a joy forever." It is sad to break up these delightful fables, but the sail merely clings to the shell, and the shell is merely the egg-case or float for the strange creature.

Drifting along, the rocks are now seen to be covered with seeming flowers. They are sea anemones, here of the largest size, virtual giants, and when open with all their tentacles expanded, the flowers of the sea certainly, in shape and color. In these big anemones, which are cousins of the corals, a little fish lives, darting into the mouth and living in the stomach or intestine of the animal. A long, slender fish also lives in one of the sea-cucumbers which we have always in sight, the trepang of the Chinese, and in Malay an article of export. Here, also, are small star-fishes, some like snakes, uncovered by the waves as they come slowly in. Near them, its head projecting from the crevice, is the moray, a big eel-like fish four feet long, with fangs that

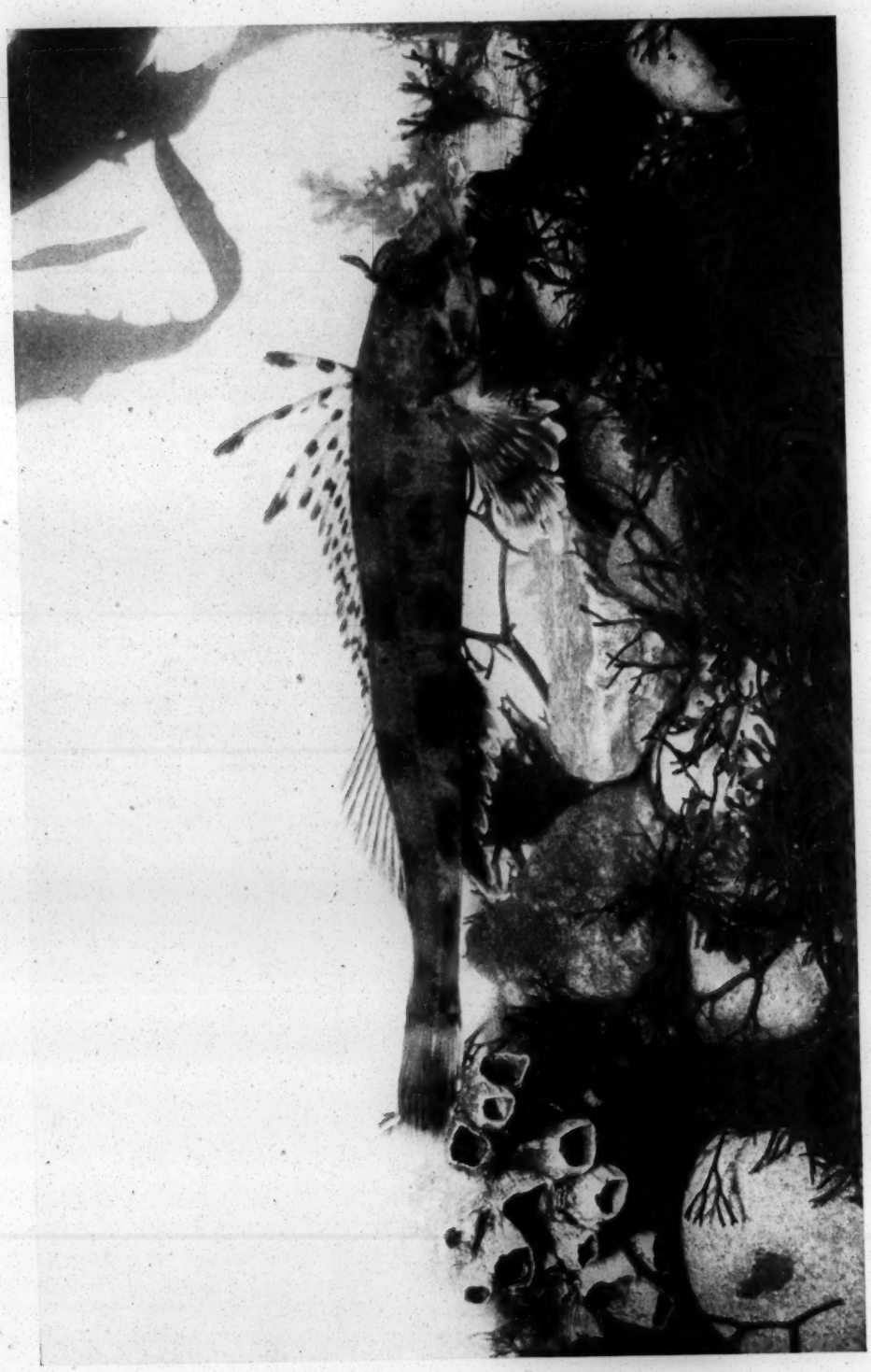
GIANT JELLY-FISH (SEE PAGE 767)



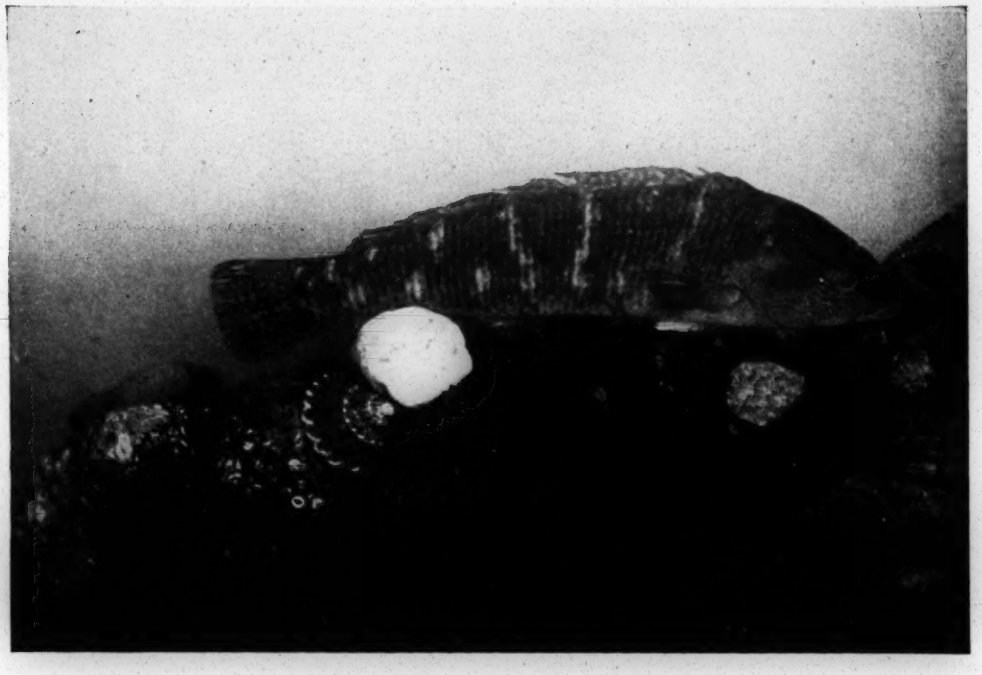
GIANT SEA ANEMONES

call to mind the rattlesnake—a ferocious fellow that strikes like a snake and is to be avoided.

Some of the fishes here, as the Indian-head fish, appear to have outdone themselves in the richness of their coloring—blazing in blue and reds, while the dorsal fins are really plumes dashed with blue or black. The eye of this fish is large and a vivid blue. Over them are two antennæ which move about in a comical way. Crawling in the weed are big crabs, gigantic pseudo-spiders, and by examining the kelp and other weeds carefully



THE INDIAN-HEAD FISH



SPOTTED KELP FISH (SEE PAGE 777)

curious crabs are found which mimic them so exactly that some experience is required to see them.

FISH THAT MIMIC THE LEAVES AND ROCKS

Many of the fishes seen through the window are mimics of remarkable cleverness. When the slow movement of the water overturns the kelp and brings it back again, we may see a green fish about a foot long, with a long frilled dorsal fin. This is the kelp fish. For protection it mimics the leaf; and, not only this, you note that it hangs in the water just like a leaf, head up or down, so that a novice would never see it unless his attention was called to it by the attentive skipper, who perhaps has a name for it that would make the lamented Linnæus turn in his grave

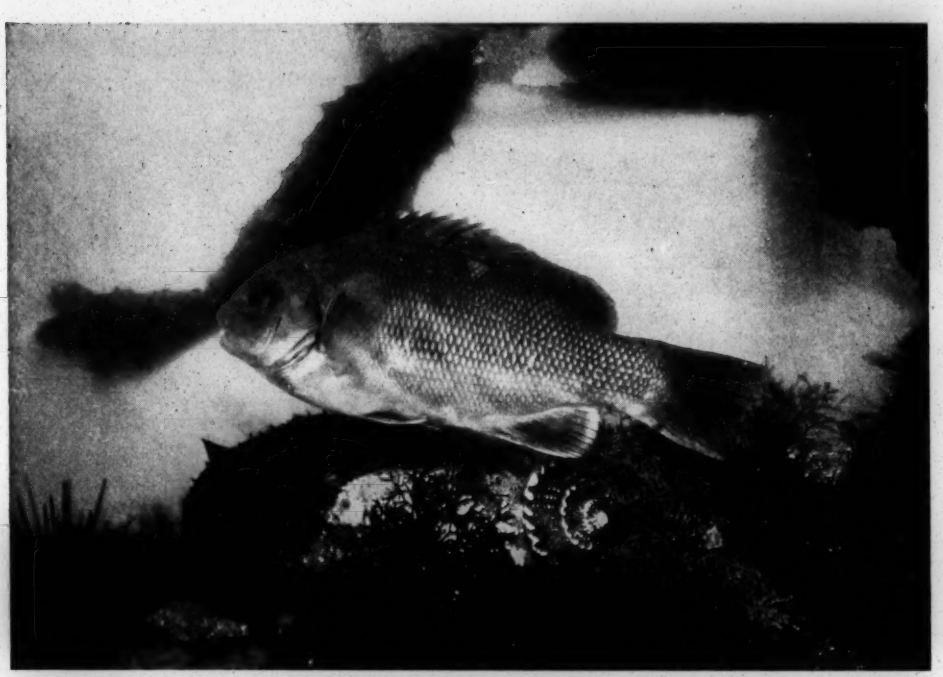
Drifting along, the passenger in the glass-bottom boat often sees the large pelagic fishes, as the yellow tail, white sea bass, or the giant black sea bass, which weighs five hundred pounds and lives in the kelp beds of the channel islands. Sharks are also sometimes seen, and on the bottom, coiled up in some snug harbor between the rocks, may be seen a very interesting shark called the Catalina Port Jackson shark. It is about two feet long, with a spine before each dorsal fin. It is sluggish and feeds on crabs at night, and lays a peculiar corkscrew-like egg, shown with the young in the photograph. For years this shark was supposed to be extinct and known only by its fossil spines; but finally some one went to Port Jackson, Australia, and found them alive; then a species was discovered on the Californian coast. It is one of the common catches in traps at the islands, and its curious eggs are sold as curiosities.

On the bottom we see rock-like objects which prove to be sculpins, so mimicking the rocks and stones that at times it is impossible to distinguish them, as they are covered with curious barbels, which look like weeds, and are black, red, yellow, and white, perfect imitations of the rocks on which they lie, ready to take any kind of a lure. If a panorama had been ar-

A YOUNG PORT JACKSON SHARK AND EGGS. NOTE THE PECULIAR CORKSCREW-SHAPED EGG (SEE PAGE 773).

DEVIL FISH: SANTA CATALINA ISLAND. SEEN THROUGH A GLASS-BOTTOM BOAT

THE MIMIC SCULPINS IMITATING ROCKS



THE BLUE-EYED PERCH

ranged it would not appear more artificial, as at every move of the glass-bottom boat something new is seen through the window, as though prearranged. The scenery changes every moment, and as there is a slight ground swell, just sufficient to lift the curtains of the weed and move them to one side, then back again, strange things constantly appear. Now the vista is green. Presto! the tidal scene-shifter makes it purple of a gorgeous hue; then comes the cavern of the sea, "In gulfs enchanted where the Siren sings," faced with a most delicate green, in which swim blue and gold fishes.

BLUE-EYED PERCH

Drifting out a little, into water thirty feet deep, we see that Santa Catalina is a big offshore Sierra, as we can now look down the precipitous slopes into water of an indigo-blue shade, the most exquisite blue imaginable, with a background here and there of dim shadowy shapes. Prichard, the well-known submarine artist, has gone down in diver's armor at Tahiti and painted such scenes, and only those who have been divers or who have gone on a cruise on a Santa Catalina glass-bottom boat can appreciate their real beauty. Lying on one side is a mass of peculiar mazarine blue. In a moment we make it out as a school of blue-eyed perch of California, a fish about a foot long, with eyes like torquoise. In the peculiar light that sifts down through the kelp they appear blue, and are all headed in the same direction and lying near the bottom.

In mid-water are countless kelp fishes, graceful swimmers, while below them there are others still more radiant in yellow, white, brown, and red. They lie upon the rocks as shown in the photographs. Sometimes a shark sails slowly along with its remoras or sucking fishes following or fastened to it. They will often wander away and look curiously up into the big window down into which peer scores of faces in a row.

The big glass-bottom boats, which hold one hundred passengers, travel up and down the coast. They visit the sea-lion

rookeries and allow the voyagers to photograph the animals. It may be chronicled that a new and valuable ally to science education has been established in California in the boat with a glass bottom, through which naturalist or layman may observe animals in their habitat and note their habits unconstrained.

EXPLORATIONS IN CRETE

By Edith H. Hall

SINCE the island of Crete passed out of the control of Turkey, now nearly a decade ago, it has offered a field of exploration unparalleled for richness even in Ægean lands, where ancient remains abound. Under the Turkish regime a thorough-going exploration of the island was impossible, but since the flags of the Powers first waved above the Venetian walls at Canea; since the Italian gendarmes came to train the now efficient Cretan police, and since the power to grant permissions to excavate passed into the hands of courteous and enlightened officials, Crete has been the scene of a remarkable series of discoveries.

To the traveler arriving from Greece the island of Crete presents aspects that are exotic and foreign. The heavy Venetian walls, it is true, which greet the eye as one approaches the harbor of Candia differ only in extent and splendid preservation from the Venetian walls at Nauplia or Corfu. But the costumes of the boatmen who row the visitors ashore are Turkish; among the loiterers on the quay are Bedouins and negroes; and the first glance up the narrow, twisting, and roughly paved streets of a Cretan town will discover a Turkish balcony or a minaret and mosque. Even so, in the third and second millenniums B. C., the island must have seemed strange and foreign to a traveler from the north, for in that remote epoch also Crete was in close communication with Phœnicia and Egypt, and absorbed more elements of these civilizations than did the mainland; but of this later.

The archæologist who excavates in Crete enjoys a brilliant background for his work. When he sees for the first time the picturesque Turkish sailboats, with their flame-colored sails, rocking beneath the Venetian mole; or the colors of the market-place, where the venders wash their green stuff in the old fountain; or the fields bright, now with pink and purple anemones, now with yellow oxalis and scarlet poppies, he exclaims, "Why do the artists forever paint Capri and Sorrento and never paint this?" But when he has lived in the island some time, either renting for a trifle a house in Candia with a pebbled court and garden all his own, or living in some country village, where he learns to marvel at the unspoiled refinement and courtesy of the islanders, he is likely to offer a prayer of thanksgiving that Crete is as yet unknown to the tourist throng—that it still remains a rare prize enjoyed by occasional travelers and a handful of archæologists.

It is not an exaggeration to say that one cannot turn the soil of Crete without bringing to light potsherds—relics of the prehistoric, the Greek, the Roman, the Byzantine, or the Venetian civilizations which have flourished successively on Cretan soil. But generally these fragments of pottery are coarse, undecorated, and badly broken, and are separate from house walls. To find good specimens of well-finished decorated pottery, together with the remains of buildings, is the aim of the archæologist, and to find such remains dating from the prehistoric period is today his highest ambition, for scholars bent on solving the problems of early Ægean civiliza-

tion and Roman and even Greek remains comparatively uninteresting. The spirit of Darwin has penetrated even to archæology, and the excavators of the present have a passion for beginnings.

It is against the law in Crete to unearth antiquities without permission from the government, and peasants who by chance come upon ancient remains in working their olive orchards or vineyards are bound to report such discoveries promptly to the officials of the museum at Candia. In this way are occasionally found sites for excavating, but these sites go chiefly to the Greek archæologists. Foreigners must find for themselves their own places to dig. This they do by riding on horseback from village to village and inquiring everywhere if antiquities are found there. In response to this appeal the peasants produce all sorts of objects, from Mycenæan seal-stones of the second millennium B. C. to tops of modern beer bottles. The visitor next goes with the peasant to the place where the seal-stone, or whatever it may be, is found, and if he is lucky his first trial trench will discover an ancient house wall, and he will know that he is on the right trail, and will apply to the Cretan government for permission to conduct systematic excavations.

Such is the method used today. Ten years ago, when the island was first opened to scholars, the most promising sites, like that of the Knossos palace, were already known from the reports of peasants and the notices of travelers; and the archæologists who were so fortunate as to get these sites for digging, and whose operations in the island have lasted until now, generally have other possible sites for excavations in reserve about which they are often willing to tell to newcomers.

The number of men employed in excavations varies according to the size of the site and the funds at the disposal of the excavator, from ten to a hundred or more men. The majority of these are "basket boys," whose work it is to carry to the dump heaps the earth which is removed. Their wage is about twenty cents a day.

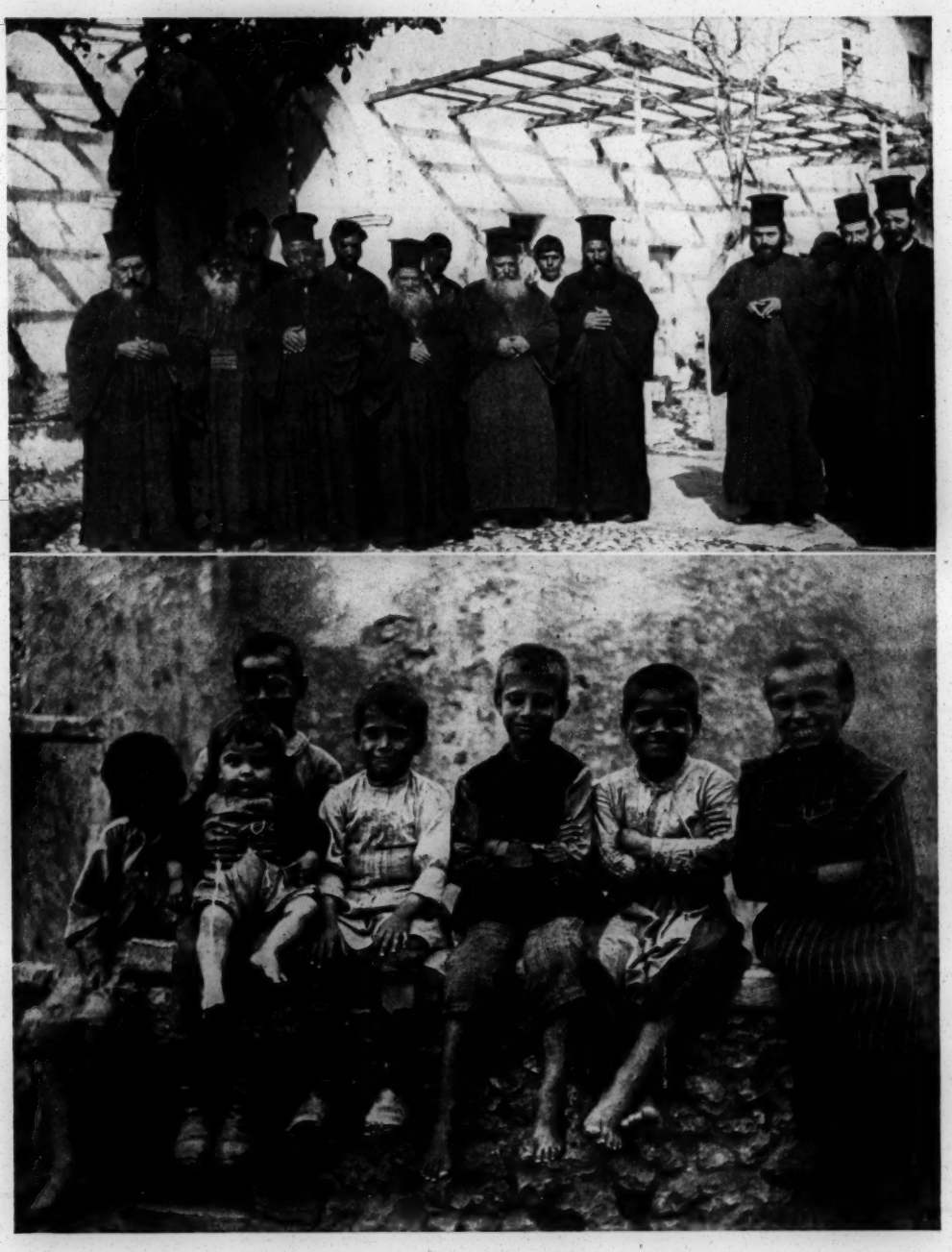
The most intelligent workmen are employed in loosening the earth with picks. They must be trained to watch with care for every scrap of pottery, bronze, or stone in the earth before them, and instantly, when they see that they are approaching a floor level on which vases rest, to stop using the pick and to work with a knife which every good workman keeps ready hanging from the top of his boot. Such workmen earn forty cents a day. Behind them are stationed the shovelers, who put the loosened earth into baskets, watching the meanwhile lest any small object be thrown away. Their wage is thirty cents.

Lastly, mention must be made of the men, or sometimes girls, who wash the pottery and pottery fragments. In some kinds of soil potsherds become incrusted with a hard formation which yields only to an acid solution. To counteract the effects of the acid, an alkali bath is necessary, and then a rinsing in clear water. During this treatment each vase or group of sherds must be kept quite distinct from its neighbors, for one of the fundamental principles of excavating is to keep an exact record of the contents of every room or given area and of the different strata within that area. This care is the result of the new scientific method of archæology which has grown up in the last thirty-five years. Excavators now dig not for spoils—as did the nephews of the popes in the fifteenth century, out of the desire to fill their villas and gardens—but for science solely. The objects found go, with a few exceptions, to the Candia Museum; only the "useless objects," so the law reads, may be exported.

To describe in brief compass the results of the last ten years of digging in Cretan soil is impossible. It would be necessary to take into account the work of Doctor Evans, of Oxford, in unearthing the palace of Knossos; of the Italian mission at Phaestos and other points in southern Crete; of the Greek scholar,

A CRETAN ROAD

CRETAN WOMEN SPINNING



MONKS OF GOMA MONASTERY, WHERE TRAVELERS ARE GLADLY ENTERTAINED

CRETAN CHILDREN

LARGE JAR AS HIGH AS A MAN, FROM THE KNOSSOS PALACE
This is now thought to be the kind of "tub" in which Diogenes lived

CRETAN BOY PEDDLING COOKIES

SCENE AT CRETAN FOUNTAIN

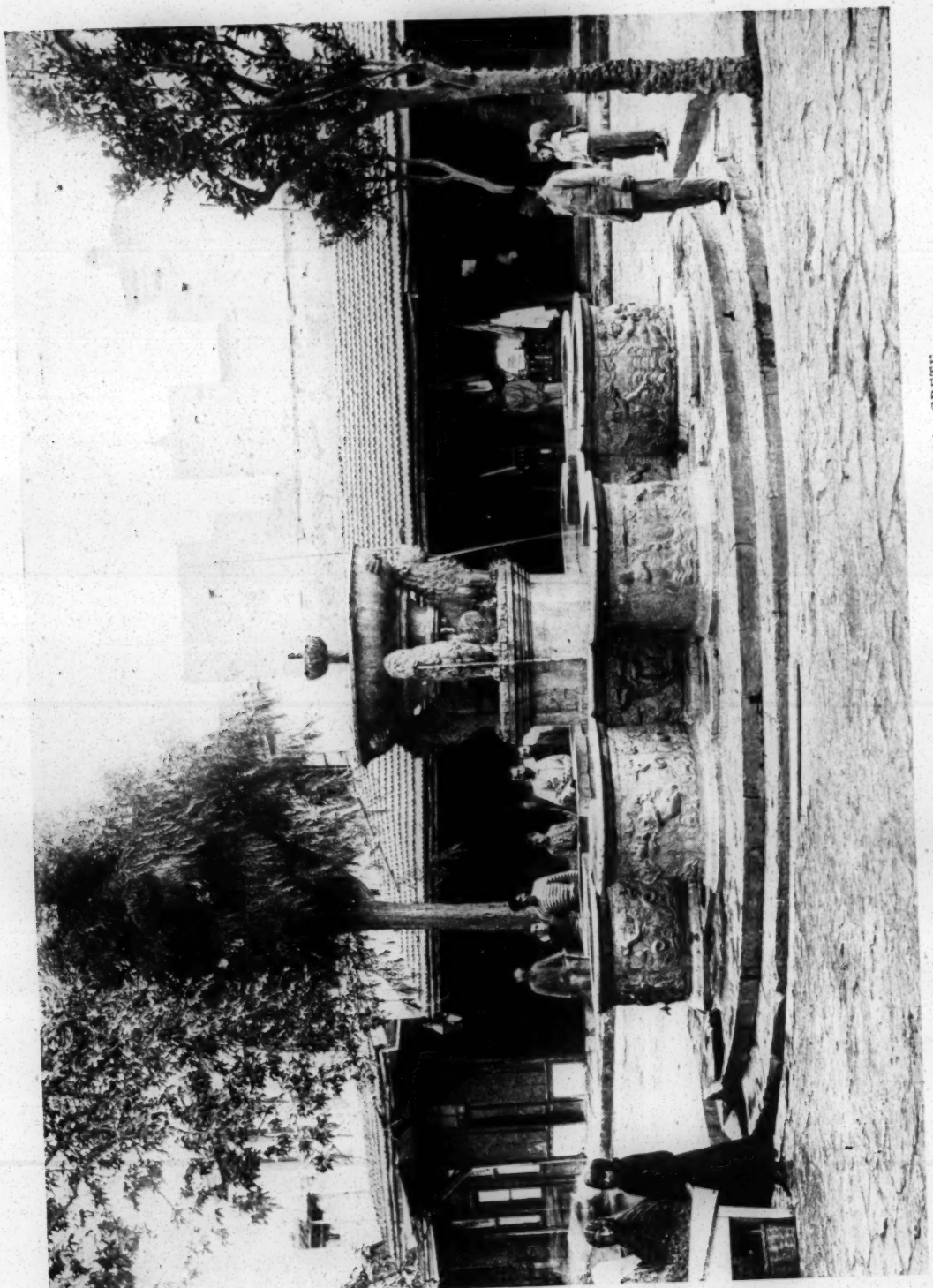
RED STONE LAMP FROM PSEIRA 1500 B. C.

OPENING CLAY SARCOPHAGUS OF 1400 B. C., CONTAINING SKULLS AND BONES

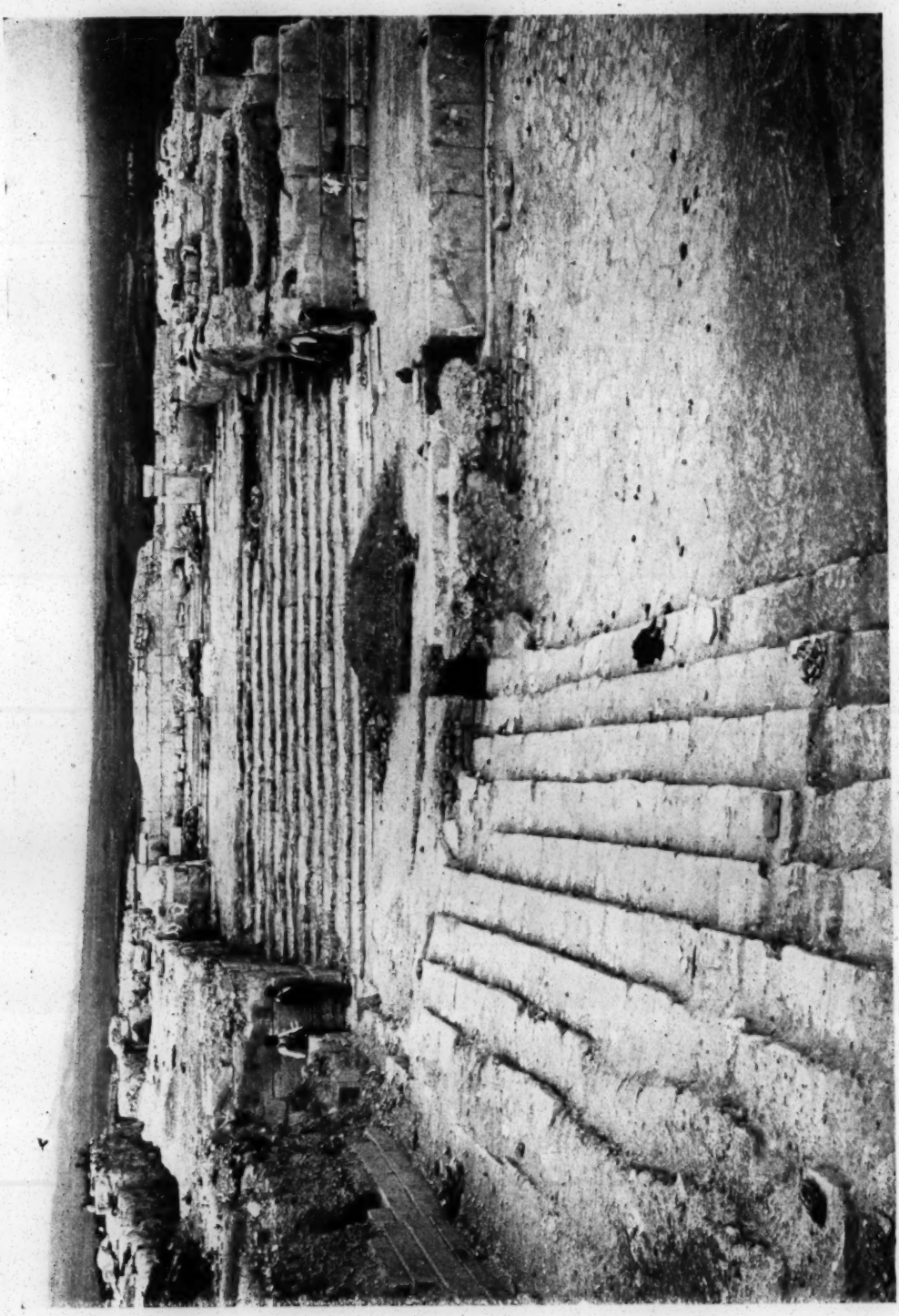
GREEK FOREMAN, ARISTIDES, MENDING A VASE

REMOVING THE LAST EARTH FROM ABOUT A VASE

CRETAN GIRLS WHO WASH THE POTTERY



VENETIAN FOUNTAIN IN THE SQUARE OF CANDIA, CRETE



STAIRS IN PHAESTOS PALACE

Mr Xanthondides, at Koremasa and other sites; of the English scholars from the British school at Athens, at Zakro, and Palaikastro, and lastly of the American excavators, Mrs Harriet B. Hawes and Mr R. B. Seager, the former at Gournia, the latter at Pseira and Mochlos. Between them they have excavated palaces, towns, and cemeteries. The palace of Knossos alone "is a more complex and extensive series of courts, rooms, and labyrinthine passages than has been met with anywhere on Greek soil."

Further, the recent investigations in Crete have evolved a system of chronology for this prehistoric era of 3500-1200 B. C.; they have shown that a high degree of artistic skill in decorative art and modeling had been attained in that remote epoch; that a system of writing was in use; that out of the hardest stones graceful vases were cut; that jewelry no less beautiful than that of the Alexandrine period was made; that boats plied frequently to and from Egypt, exporting and importing wares; that men lived in houses two and three stories high, equipped with baths and drains, and well-lighted rooms opening into sunny courts and commanding pleasant views.

The results of these explorations are adding a new chapter to history, or rather they are turning legend to history, for those who read the reports of the Cretan excavators, especially those of Doctor Evans, will not find themselves involved in the dry and dusty discussions of an antiquarian, but, as a writer in Crete has recently said, they will be carried back to the "glamour and romance of first fairy stories" about the Minotaur and the Labyrinth.

No better impression of the dramatic quality and thrill of Cretan discoveries can be given than by the following quotation. Doctor Evans has just discovered the fresco of the Cupbearer in the Knossos Palace, and writes in his first report:

A CRETAN MOUNTAINEER

"The colors were almost as brilliant as when laid down over three thousand years before. For the first time the true portraiture of a man of this mysterious Mycenæan race rises before us. There was something impressive in this vision of brilliant youth and of male beauty recalled after so long an interval to our upper air from what had been till yesterday a forgotten world. Even our untutored Cretan workmen felt the spell and fascination. They, indeed, regarded the discovery of such a painting in the bosom of the earth as nothing less than miraculous, and saw in it the 'icon' of a saint!"

THE AFGHAN BORDERLAND

By Ellsworth Huntington

Part I: The Russian Frontier

At the present day, in spite of the boasts of civilized man, five important regions of the globe still remain practically closed to him. Two are the cold polar regions; a third is the huge dry desert of southwestern Arabia; a fourth is the fever-stricken interior of the great island of New Guinea; while the other three are the countries of Nepal, Tibet, and Afghanistan, among the lofty mountains and cold plateaus of the center of Asia.

In all seven cases extreme conditions of geographic environment are the cause of the exclusion of civilized man. In the polar regions and in the vast unexplored portion of Arabia extreme conditions of temperature or of aridity are in themselves enough to prevent the occupation of the country by man. In the other cases geographic environment accomplishes its function of exclusion in part directly, by making the regions difficult to traverse, and in part indirectly, by fostering in the inhabitants a spirit of exclusiveness and warlikeness, or by imposing upon civilized nations certain peculiar political conditions.

Among the closed countries of the world the degree of exclusiveness seems to increase in proportion to the political importance of the regions concerned. Thus there is at present no country which is more difficult to enter than Afghanistan, and none whose isolation is likely to break down so soon. This is due in the first place to the fact that the power which holds the Afghan mountains holds a strategic position of the highest importance in regard to India. Therefore England naturally has the most serious objection to any attempt by the Russians to obtain a foothold there.

In the second place, from Constantinople on the west to Manchuria on the east there is no place where the natural configuration of the country offers so easy a route from the Russian possessions in Asia to the southern ocean as through the western portion of Afghanistan. Consequently it is highly desirable for Russia to control this route, and she is naturally loath to see England supreme within the Afghan borders.

Thus it happens that both countries are willing for the present to leave Afghanistan in independence, and to allow the naturally wild and exclusive temper of the Afghans to have free play.

An account of the experiences of the writer upon the northwestern border of Afghanistan, where its territory adjoins that of Russia; upon the western border, where the country touches Persia, and upon the southwestern border, where English influence begins to be felt, will illustrate the degree of inaccessibility which now prevails in this most exclusive of kingdoms.

In the winter of 1903-1904 the writer, in company with a young Russian official, traversed the entire western frontier of Afghanistan. We did not desire to penetrate far into the country, but the study of certain geographic and geologic problems, such as the broad break in the mountains which gives such easy access to the country on the northwest, the great depression which determines the border between Afghanistan and Persia, and the fluctuations to which the enclosed lakes of Khaf and Seyistan are subject, made it highly desirable for the writer to be able to cross the frontier, while his Russian companion hoped to win fame and promotion by penetrating into some of the military secrets of the Afghans.

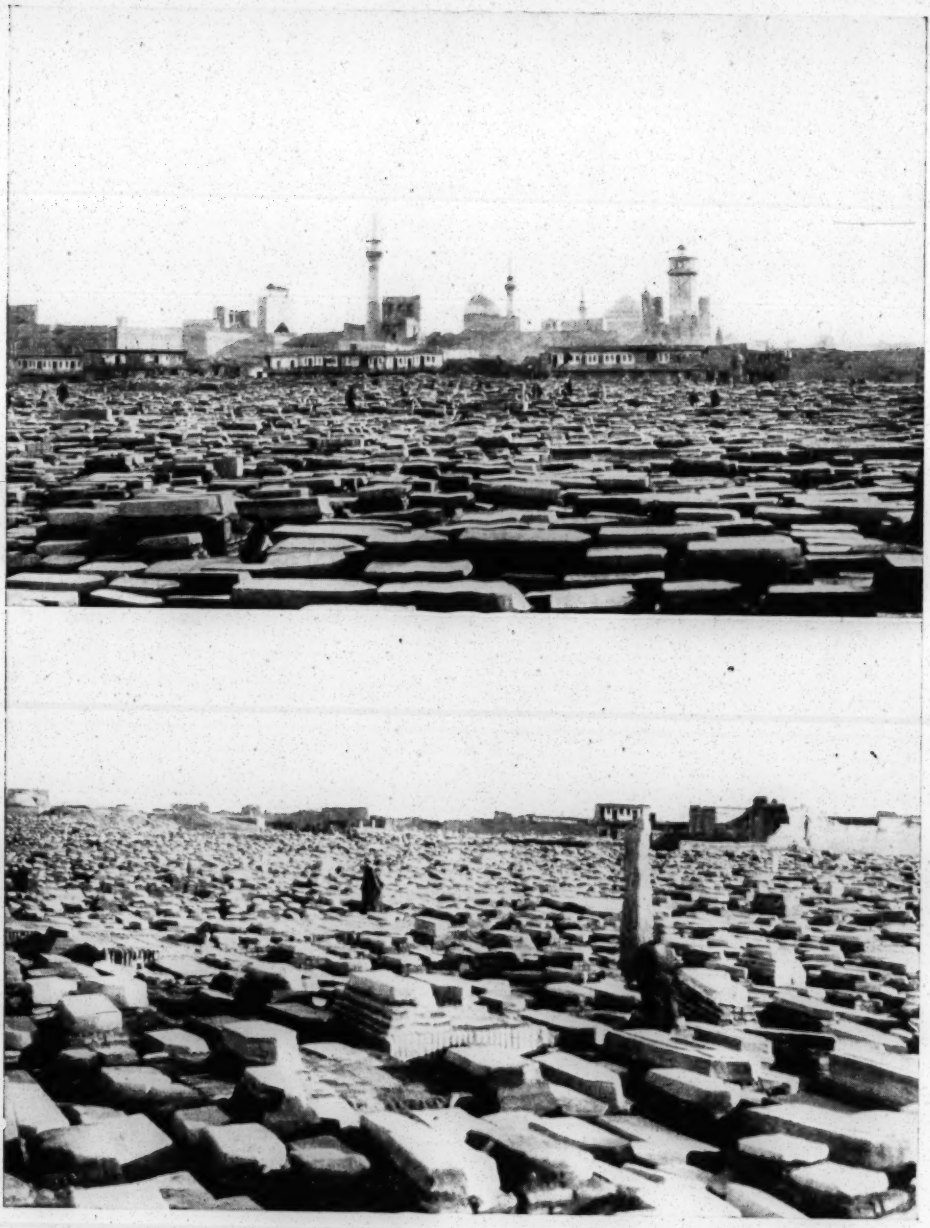
Late in November I started ahead of my companion from Askhabad, the cap-

TURKOMANS IN THE SANDY DESERT OF TRANSCASPIA DRAWING WATER FROM A WELL BY MEANS OF LEATHER BUCKETS

The water is poured into a wooden bowl for the horse to drink

A CARAVAN-SERAI IN THE DESERT OF EASTERN PERSIA

The view is taken through the gate and shows the curious crowd assembled to watch the departure of the foreigners



THE TOMBS OF MESHED, THE MOST HOLY PLACE IN PERSIA

The bodies of thousands of Mohammedans are brought here to be buried in the space around the shrine, which is literally covered with tombstones

ital of Transcaspia, and went by rail to Dushak, a little station a hundred miles to the eastward, whither our caravan had preceded me. There the Transcaspian railroad bends to the northeast to reach Merv, while our route led to the south-southeast, along the broad sloping plain of gravel at the northern base of the mountains which form the boundary between Asiatic Russia and the extreme northeastern part of Persia. The first day's march was short. The following morning a splendid red sunrise ushered in Thanksgiving Day, clear and bracing, as November days are apt to be in the dry Russian province of Transcaspia. All day the caravan moved slowly eastward—four men, five horses, and three baggage camels — strange, grunting beasts, whose long, pliant necks and awkward legs were oddly suggestive of huge picked chickens, especially when seen from in front.

During the four months of hard traveling in eastern Persia to which this day's march was the prelude, the caravan developed splendid efficiency, but as yet it was not well shaken together. We had spent an uneasy night, which began with a search in the dark for a camping place and for water, firewood, eggs, and milk, and which ended with a nightmare of a dragon licking his chops and writhing his coils about us. We awoke to find that one of the common incidents of camp life had occurred—the camels had gotten loose, and in their attempts to eat the leaves of the cultivated poplar tree above our tent were kicking the tent ropes with their crooked legs and setting their rubbery, compressible feet upon the pegs.

All day we saw no sign of man except the ruined mounds of the civilization of the past, and no sign of animals except herds of sharp-horned, slender gazelles browsing on the brown remnants of the sweet, meager growth of short grass which flourishes for a month or two after the rains of early spring. Once a herd of about twenty of the graceful fawn-colored creatures followed us for an hour out of curiosity, sometimes coming within a hundred yards of the path, so that we could see every movement as they gamboled and played under the influence of the crisp fall air, and sometimes chasing one another in great circles or dashing off for half a mile, so that nothing could be seen of them except white tails bobbing up and down as the graceful creatures leaped over bush and stone. For them a run of twelve or fifteen miles to a drinking place was a matter of no consequence, and therefore they could live in the dry plain from which slow-footed man is excluded for lack of water.

Toward sunset signs of the presence of underground water appeared, and soon we came upon sheep and camels grazing amid the tamarisks of a broad, shallow valley wherein no stream was to be seen, but only a few slightly brackish wells and a disorderly group of round Turkoman tents, some of them made of gray felt and others of reeds plastered with mud. Not far away, upon a gravel slope, a cluster of low, neat buildings, with whitewashed walls of mud and stone and roofs of tile, presented a marked contrast to the slovenly Turkoman structures.

Sturdy Cossack sentinels, in long woolen cloaks and huge sheepskin caps, were pacing to and fro, and stopped us sharply as we approached. An American, even though accompanied by a uniformed Afghan and Turkoman who were enlisted in the Russian frontier army, must show very good reason for approaching a military post in the vicinity of turbulent Afghanistan. Only the closest scrutiny of my papers, signed by the military governor of Transcaspia, convinced the sergeant who was temporarily in charge that I was not a spy whose arrest would bring him much credit. Once convinced, however, he was a true Russian in his hospitality. He had not much to offer, for the quarters and provisions of his absent superior were not at his disposal. The best that he could do was to allow me to share with himself and a corporal a cold, stone-floored sleeping-room.

AN AFGHAN SOLDIER IN UNIFORM

TWO PERSIAN FAKIRS, SUPPOSEDLY HOLY MEN, WHO GO ABOUT SINGING, DANCING, PLAYING, AND BEGGING

A VILLAGE AND IRRIGATED FIELDS ON TERRACES IN EASTERN PERSIA

PLOUGHING WITH HUMPED BULLOCKS AND A WOODEN PLOUGH ON THE BORDER OF AFGHANISTAN

A POVERTY-STRICKEN PERSIAN FAMILY CROUCHED BESIDE THE MUD WALLS OF THEIR HOUSE INSIDE A HIGH MUD WALL PUT UP FOR PROTECTION AGAINST AFGHAN BANDITS

A GROUP OF AFGHAN NOMADS

Dinner that Thanksgiving night consisted of a first course of black bread, milk, and tea, followed at an interval of an hour by "borsh," a favorite Russian soup full of large pieces of potato, beet, and carrot, floating amid chunks of mutton. The sergeant and his comrades evidently suffered sadly from ennui; discipline was naturally lax in so remote and uninspected a post, and drunkenness and gambling were too common to excite remark. Yet, in spite of this, one could not help liking the patient, good-tempered Cossacks, for there was an air of strength and vigor about them—the attitude of a conquering race.

During the next ten days I visited other lonely frontier stations, the largest of which was Serakhs, a Turkoman town at the very northeastern corner of Persia. Here the "pristav," or local executive officer, when he heard of the presence of an American, insisted upon my becoming a guest in his pleasant home. It was most interesting to see how this educated, energetic young man and his girlish wife made the modest executive dwelling an oasis of European culture in the midst of the Transcaspian desert. The effect was marred somewhat by the tall Cossacks who waited on the table, did the cooking, and wheeled the baby in its carriage; but, as Mrs Pristav said, "A Cossack is the most careful kind of nursemaid, and, besides, we can't get any girls or women here."

At the military club, the social center of the community, the remoteness of the place was much more evident than in the pristav's house. As there was nothing else to do, every one, including the priest, gambled and drank. When the regimental band began to play, I fear my face must have shown my feelings, for an officer's wife who had lived in Germany and England remarked, plaintively, "Does it sound very badly? When I first came I used to think it sounded terribly out of tune, but now I can't tell whether it is right or not. I believe I like it out of tune."

At Serakhs I was obliged to wait several days for the young Russian official who was to be my companion in Persia. The time was well spent, for the chief of the Department of Agriculture of the province invited me to go with him on his annual tour of inspection to the pistachio region, fifty miles to the south, on the border of Afghanistan. Part of the way we went by wagon and part on horseback, riding Cossack horses belonging to our escort. Once we stayed at a post where the wife of the captain was the only white woman within forty-five miles.

Again we crossed into Persian territory, and were struck by the poverty and dilapidation of the Persian military posts, which are supposed to offset those of Russia. When told that certain men were soldiers in uniform, I could see that among their rags an occasional brass button was hidden, but otherwise the soldiers and the beggars looked alike.

We found the pistachios growing upon low, bushy trees on the slopes of the gently rising mountains which form the Afghan border. The tree is so resistant to drought that the Bureau of Plant Industry of the United States deems it one of the most useful plants for introduction into the arid regions of our own country. The Russian government derives quite a revenue from the sale of the wild crop to Armenian merchants, who employ Turkomans to gather the nuts.

A Russian servant, Mikhail by name, shared all my journeyings in the Afghan borderland. On the first day of his service he reported for duty hilariously drunk, a condition of which he appeared to be much ashamed when he was sober. When he came for orders in Serakhs the pristav's wife, who had no fear of wild Turkomans and was accustomed to Cossacks as housemaids, was quite frightened. "I thought he was a robber," she said, when she saw him come into the kitchen with his rough sheepskin jacket, high boots, tilted Turkoman busby of sheepskin, shaggy brown beard, and sharp blue eyes.

In spite of his appearance he was a most lovable, gentle man—faithful, resourceful, and honest, a good hunter,

A COMFORTABLE PERSIAN VILLAGER

A WELL-TO-DO PERSIAN FAMILY

The women and girls of the family would not let themselves be photographed or even seen

A SACRED PLATFORM DECKED WITH WOODEN BIRDS

This is carried in processions at the time of the great feast of the Shiah Mohammedans in mourning for the death of Hassan and Hussein, grandsons of Mohammed

A PERSIAN VILLAGE OF DOMED MUD HOUSES COVERED WITH SNOW. BACK OF THE HOUSES STANDS A ROW OF WIND-MILLS

and always ready for work except when he became drunk—in short, a typical frontiersman like those of the "Wild West" of America a generation ago. He belonged to a heretical sect much given to holding long meetings, at which first one and then another, and finally several at once, shout out prayers at the tops of their voices. His family and other co-religionists had been transported to the Persian border and placed there in colonies, partly to get rid of their disturbing presence at home and partly to form a cordon of genuine Russian settlements along the exposed frontier.

Everywhere along the boundaries of Asiatic Russia military preparations are strongly in evidence. Nowhere is this more noticeable than at the corner where Russian territory adjoins Afghanistan and Persia, for here, as has been said, lies the one easy line of communication between northern and southern Asia in the whole vast stretch from the Bosphorus to Manchuria. Evidences of the importance of the region are found not only in the numerous military posts and in the colonies established for military purposes, but in the railroad spur some one hundred and seventy-five miles long which, at a distance of about sixty miles east of Serakhs, runs southward from the Transcaspian Railway at Merv to the Afghan frontier at Kushka. The fact that I traveled on part of the railroad aroused much ire on the part of several Russian officers, especially an irascible black-bearded colonel, and I should have been arrested immediately had I not been the guest of an official.

In general, the officers to whom I had introductions were proud to point out the barracks and to tell how the soldiers were cared for, but took great pains not to mention the number of troops or guns. They could not conceal the fact that equipment for an immediate advance was on hand in case there should ever be occasion to invade Afghanistan; and one of them said with pride that the large storehouses from which I was warned away at Askhabad contained the rails, ties, and complete equipment for sixty or seventy miles of light railroad, which could be laid down at a moment's notice, to connect the end of the Kushka spur with Herat, the chief city of western Afghanistan. Others may have overlooked the importance of the break in the great mountain chains of Asia which occurs in western Afghanistan and eastern Persia, but the Russians realize that some day it will be one of the world's great lines of communication.

The attitude of Persia toward affairs in the eastern part of her domain may almost be neglected, so far as its practical results are concerned. On leaving Serakhs, our first night in Persia impressed upon us the contrast between the business-like methods of Russia and the slipshod Persian way of doing things.

Arriving at Zorabad after sunset, we stumbled through the dung-heaps which, by courtesy, are called streets, and arrived at the wretched house of Mehemet Yusup Khan, the redoubtable chief of the three or four soldiers—nominally thirty—who are supposed to defend this frontier town against the Russians and Afghans. The floor of the single apartment was about two feet below the courtyard in which the horses were stabled. The furniture consisted of a few bags hung on wooden pegs driven into the mud walls, and a few dirty felts and bags that partly covered the floor, also of mud. The sooty roof of the apartment was nearly seven feet above the floor, but such spacious dimensions were too high for the door, before which one was obliged to stoop low to get through its four feet of height.

The only window was a round hole about a foot in diameter, which was filled by half a dozen fowls that had taken refuge there from the cold December air, and that helped to lessen the draft on the people inside. Such, at least, was my thought until sunrise, when a boy walked unceremoniously into the room, and, picking up the sleepy hens, put them out into the cold through the door. The window was not a window at all, but merely a niche in the thick wall.

Throughout our stay in eastern Persia we everywhere found conditions much the same as in Zorabad. Poverty is the rule, and with it go shiftlessness, lack of neatness, lack of ambition, and vices such as opium-smoking. It hardly seems fair to condemn the Persians for these things. In other parts of the country conditions are much better. In the eastern half of Persia, however, there is so little rainfall that no crops can be grown except in a few pitifully poor oases. No one can hope to prosper greatly, no matter how hard he may work. Therefore the inhabitants stagnate and play no part in the present history of the country except as pawns to be harried by the Afghans, cowed by the Russians, or cajoled by the English.

WITH THE MONKS AT METEORA: THE MONASTERIES OF THESSALY

By Elizabeth Perkins

THERE is a legend, perhaps it is history, that there was once a ruler in Constantinople who disliked his brother and wished to banish him to the remotest corner of his kingdom. Consequently the monarch built a monastery on a well-nigh inaccessible mountain in Thessaly and founded a brotherhood, about four hundred years ago, in what seemed to be the uttermost corner of the earth.

The monastery was called "Meteora," meaning "domicile of the sky." After the original was built, twenty-three others grouped themselves around and were inhabited for awhile. They were, however, finally abandoned, with the exception of three which are still in use.

To reach this settlement one can go directly from Athens by train in thirteen hours, for the railroad has been lately finished; or one can cross Thessaly in seven hours by train from Volos.

The season of good weather commences in April, when the mountains are green and yellow with gorse and the sun shines almost continually. Earlier there are apt to be heavy rains, and the spring thaw causes a mist to rise from the frozen mountains which obscures the view, while the snow, melting into the earth, makes mud one or two feet deep and traveling on horseback is almost impossible.

If, however, one is fortunate enough to hit the last of winter, when the sun shines and the mountains are still resplendent in their dazzling whiteness, then one sees them in all their glory. The rocky eminences on which stand the twenty-four monuments of man's erstwhile habitation seem to forbid nearer approach, and yet they lure the adventurer to them by their danger.

The seven hours' trip across the plains of Thessaly to the town of Kalabaka is most enchanting. Range after range of hills roll up from the plateau. The foothills in winter are powdered with snow, as though an angel had shaken the down from his wings; the higher hills are whiter and bleaker, and the highest hills are as pure as the drifting clouds into which they seem to melt and disappear into highest heaven.

On the plains flocks of goats and sheep, attended by their shepherds, are spread so numerously over the land that mushrooms in a field never appeared more abundant. The shepherd himself is a picturesque person. His legs are encased in long, white leggings, ending in pointed, turned-up shoes adorned with tassels. A sheepskin hangs from his shoulders and a staff with crook is carried in his hand.

Our train crawls over the hills and across the plains at the rate of ten miles an hour, and the sheep-dogs run barking

BARLAAM, WHERE WOMEN ARE NOT ALLOWED AND WHICH CONTAINS A REMARKABLE BYZANTINE LIBRARY

Access by the rope bag, also by the frail and swinging ladder, built against the rock. The ladders and rope show in this picture, but not the bag

by its side; indeed, for a short distance they often outpace the train.

The villages, invariably set back from the railway, are far better to look at in the distance, for the stucco houses are not attractive near to; but their flat, red roofs add a pleasing touch of color to the middle landscape.

Occasionally a Greek priest, with long beard, long hair, and long garments, rides by. His high hat and his large cross indicate prominently his calling, and, if he is not in too great a hurry, a pedestrian may stop him, kiss his cross, and be touched on the forehead with a little switch, presumably dipped in holy water, and the sinner obtains absolution for the day.

We left the train at Kalabaka, and there took horses and guides to climb to the high-built monasteries. For three hours the horses had to pick their way over hillsides where, in the month of February, no trail was visible.

The snow grew deeper as we mounted higher, and the coating of ice on the rocks made our progress slow and slippery. Up the bed of streams we went, fording the rushing waters, which bespoke spring freshets, and quite suddenly we came upon a rock formation so awe-compelling from its immense height and forbidding steepness that Doré could have imagined no more formidable bulwark.

Andromeda might have been chained to one of these sheer rocks, and the eagles that swoop, and dip, and circle among them could have been the only thing to reach her, until Perseus came to set her free. In those days the valley was evidently a body of water and could easily have harbored a monster of the deep. Now a river winds along, like a shining thread, with wide sandy banks, that indicate the presence of a wider sheet of water not so very long ago.

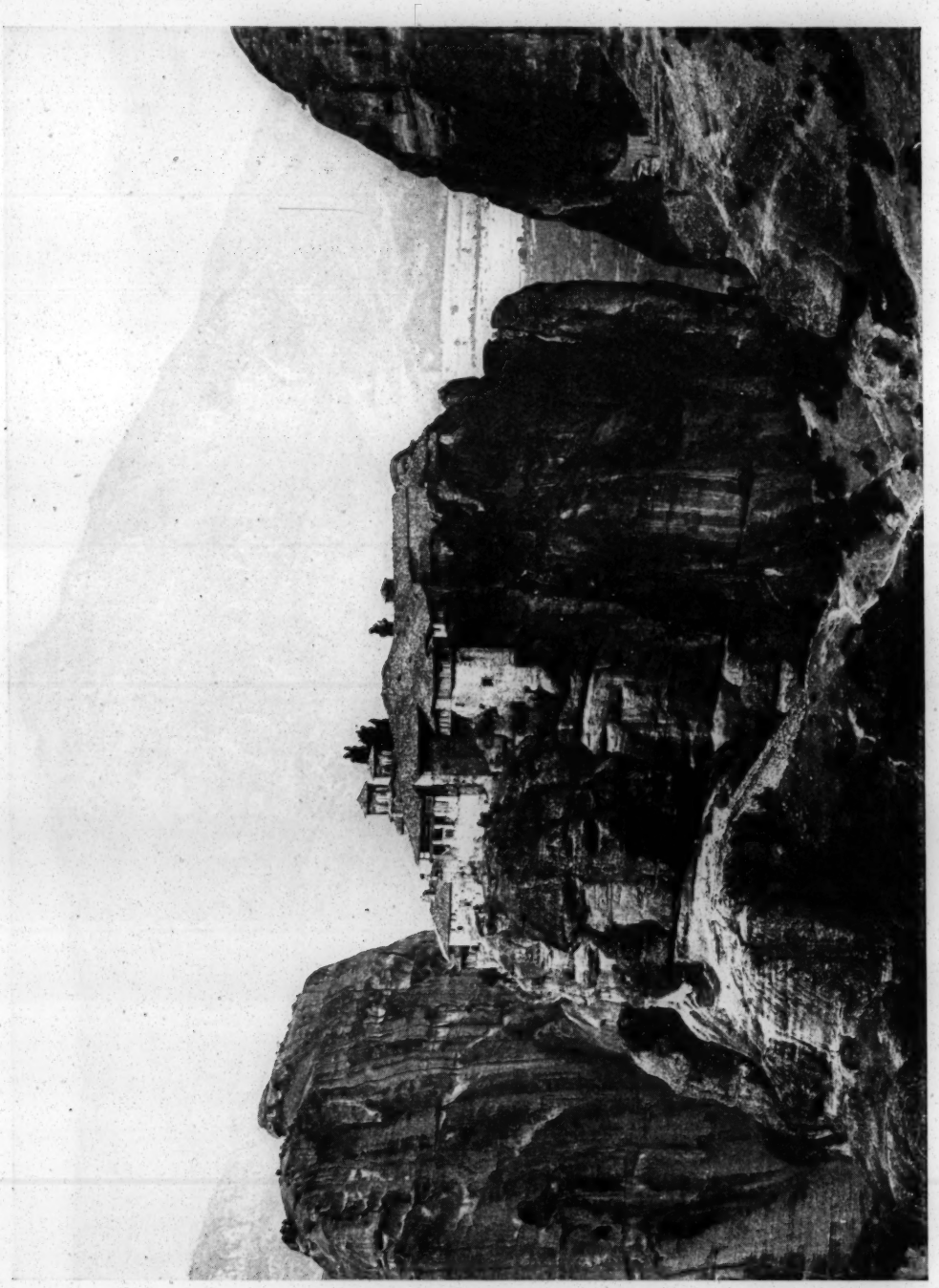
As we looked in wonder at one detached colossal pillar of stone, we discovered on its seemingly unattainable summit a building! This habitation of man, half natural rock and half artificial, seemed most extraordinary. Our guides drew attention to the higher precipices, and as we grew accustomed to their outlines we saw, on all sides, monasteries tucked into the ledges of the perpendicular walls. They are not all inhabited today, but they are there, bearing testimony that man has climbed, and built, and lived on crags that seem impossible for goats to climb.

The first abode of the contemporary monks is Barlaam, which is said to contain a wonderful Byzantine library; but entrance to this monastery is barred to women. However, the cloistered brothers are not forbidden to look at passing femininity, even if they cannot harbor them, for they called out to us as we passed below them on the mountain side, and we answered back, "Good day." An hour further on we caught sight of another monastery, Trinity, and there upon arrival we were allowed to enter.

The whole of the west plain of Thessaly lay at our feet, and the white mountains of the Pindos range rose rugged and imposing before us. At the base of the rock on which Trinity is perched, like an eagle's nest, our guides hallooed and beat with a stick on a tin can, found in the bushes. Soon an answering call came back, and over the precipice, some three hundred feet above us, the peering faces of several monks were seen. Then something serpentine flew into the air, and as it dropped perpendicularly we saw dangling from a coil of rope what looked like a small fish net. Down came the cable until it touched the earth at our feet, and the fish net proved to be a large-sized rope bag, which opened and spread out flat on the ground.

One at a time we were invited to step into the middle of this net and squat, Turk-fashion. The edges were gathered together onto a large iron hook, a shout was given, and the net soared upward, while its occupant felt somewhat like an orange at the bottom of a market woman's bag.

The ascent takes just three minutes. Occasionally the openwork elevator swings into the rock with a slight bump, but the monks at the top wind the windlass slowly, and the bumping doesn't



ANOTHER VIEW OF BARLAAM AND THE PINDOS RANGE OF MOUNTAINS

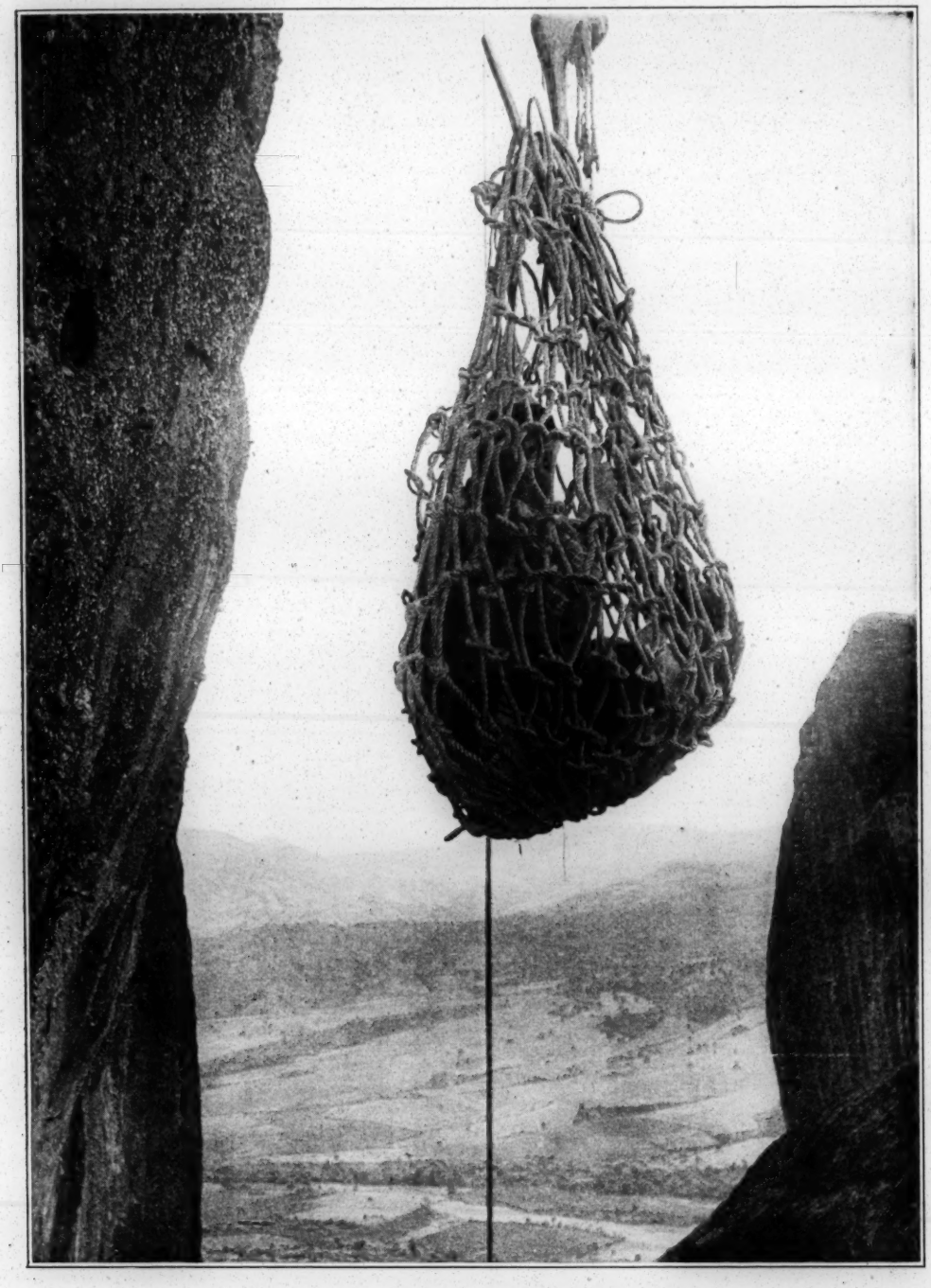
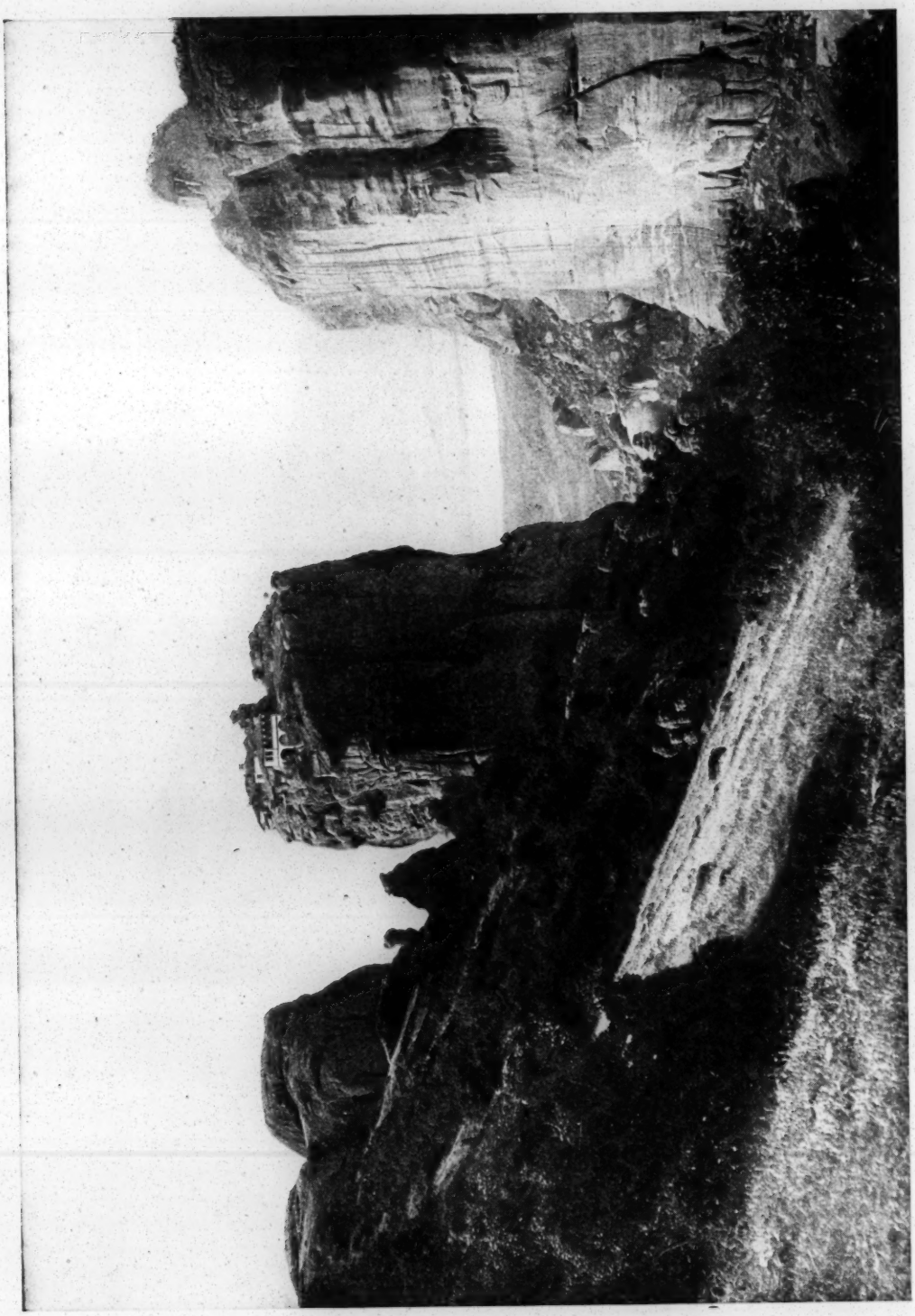


Photo and Copyright by Underwood & Underwood, New York

MONK ASCENDING TO MONASTERY OF SAINT BARLAAM IN A ROPE BAG DRAWN BY A WINDLASS (SEE PAGE 801)



TRINITY, WHERE WOMEN ARE ALLOWED AND ALL VISITORS ARE DRAWN UP IN A ROPE NET

VIEW OF THE ROCKY FORMATION AND AN ABANDONED MONASTERY
Note the cultivated fields in the valleys

hurt, but as a compensation the view grows more beautiful every second. At last the top was reached. There was a final swing outward, to get a rebound inward, several pairs of hands were outstretched to pull the net over to the platform, and then came a drop onto the stone floor! The hook was detached, the meshes opened, and the passenger helped to her feet by the black-robed brothers. They all gathered around with words of welcome and hands ready to be shaken in greeting.

The first place visited was the chapel. The youngest monk, with full red beard and hair twisted into a psyche at his neck, acted as *cicerone*. The others straggled on behind. The small chapel was Byzantine in form and in decoration. Frescoes covered the walls. Silver lamps hung from the ceiling and before pictures of saints crowned with silver and many having silver hands extended in blessing.

With many apologies this brother showed us his cell. A studded door which led to it was so low one had to stoop to look in. Its walls were whitewashed and its window grated, but the bed, though narrow, had a gay chintz cover, as did also the table, and around the wall was a shelf of books. Several photographs of other monks indicated his desire for decoration, and even suggested that could we have looked into more guarded places we might have found souvenirs of sister or erstwhile sweetheart.

Washing arrangements there were absolutely none. The visitors' parlor and the room reserved for guests to sleep in were scrupulously clean. As we were writing in the visitors' book a lay servant entered with a tray bearing water glasses, liquor glass, and a glass of red jelly with spoons. We took a teaspoonful of jelly made from some wild fruit, and then the monk-made cognac. Both were delicious, and bore testimony to the fact that even monks, though barred from many pleasures of the world, cater to the pleasures of the stomach. All we had to offer in return for their hospitality were some American postcards.

The Flatiron Building caused much unintelligible comment, but also the perfectly understandable remark that "this must be the Meteora of America." Our red-haired friend also made us understand the superiority of the original Meteora in having a net bag to facilitate the mounting. Alas! we could not make *him* understand the greater superiority of an electric lift.

The oldest monk was very cross; nevertheless he took the postcard and stuck it in the frame of the patron saint which hung above the visitors' book, and when the next American writes his name therein he may gaze with amazement at his home monuments and think indeed that the world is small.

After having enjoyed their hospitality we finally bade our hosts goodbye and again squatted upon the net. When its meshes were gathered onto the hook and all made ready, there was a sensation of *goneness* as the final push was given and over the brink went net and passenger and below was three hundred feet of space.

Horses and guides were awaiting our return at the foot of the mountain, and we rode on to the monastery of Saint Stephen. This monastery is perched no lower than that of Trinity, but it is accessible by a bridge across a chasm. At the end of the bridge a nail-studded door was opened to us, and through a low-vaulted stable, where dogs, and pigs, and sheep, and goats evidently took refuge, we passed into a courtyard, and on the steps of the cloister stood another monk ready to receive us.

We had a letter of introduction to him, which told our intention of coming, and he greeted us with dignified cordiality.

The chapel was first visited, then the visitors' parlor, and finally we were shown our room for the night. Whitewashed walls tinted blue, grilled windows, an open fireplace, raised high from the ground and piled with firewood, and three iron beds offered us hospitality for the night.

We had the afternoon and evening before us and it promised to be a long one. When our guides and horses left us to

return to Kalabaka, we were alone with the monks, who spoke only their own language, and, like all Greeks, were not very quick to understand the universal language of signs.

Fortunately we had playing cards with us and we started "Canfield." Then we stopped, thinking it might be forbidden to the holy order and a breach of hospitality for us to indulge in the recreation. But the monk who acted as special host saw us and motioned us to continue. Then he drew up a chair and watched. Soon he sent for another monk who came hurrying in, smiling, and watched too. Then we offered to let the monks play, and they did with alacrity. They played for an hour, and then they taught us a game of their own—a very good one too, with excellent opportunities for gambling. Although they played with the assurance that bespeaks frequent indulgence, still no money passes through their hands save that which is used for the poor. There is little occupation in these monasteries for those in retreat, and they voluntarily go among the poor in the near country and do much to relieve them.

Saint Stephen's is said to have a good revenue from property it owns in Volos, and as the brotherhood is free to any who wish to enter, it must have a certain income to support even its few inmates.

Our supper was served by the lay servant, while a monk hovered near to see that we had all we wanted. A hot rice soup, cold chicken, hot fricasseed chicken, rye bread, and red wine should satisfy the most fastidious, and for a sweet dish we had a cake made of chestnuts.

The following morning we were bade adieu and given Turkish coffee before we left. On our way down the mountain we wondered who could have been the first man to climb the first peak to lay the first stone on a point where birds hitherto only had rested.

THE PREHISTORIC RUIN OF TSANKAWI

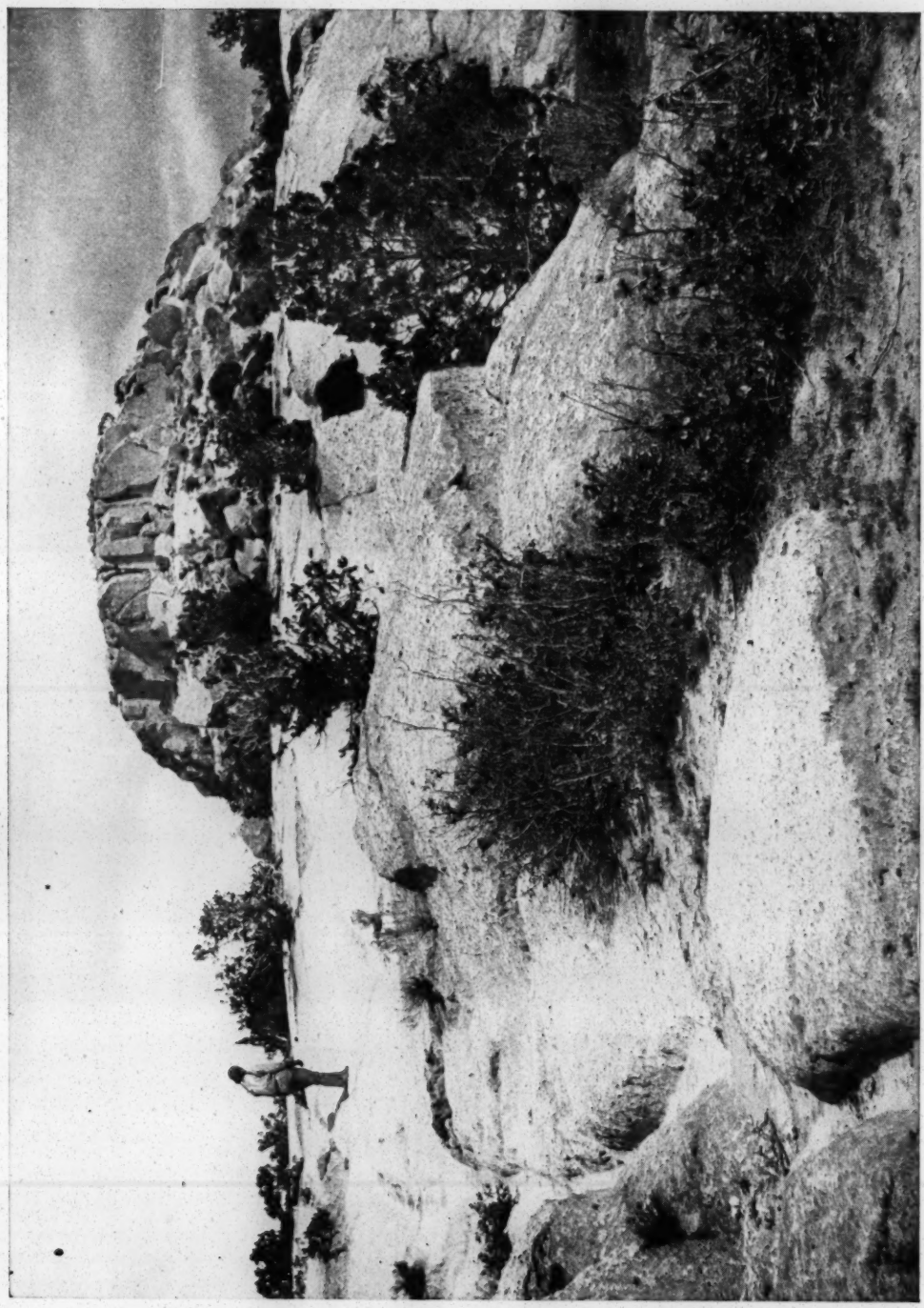
By George L. Beam

With Photographs by the Author

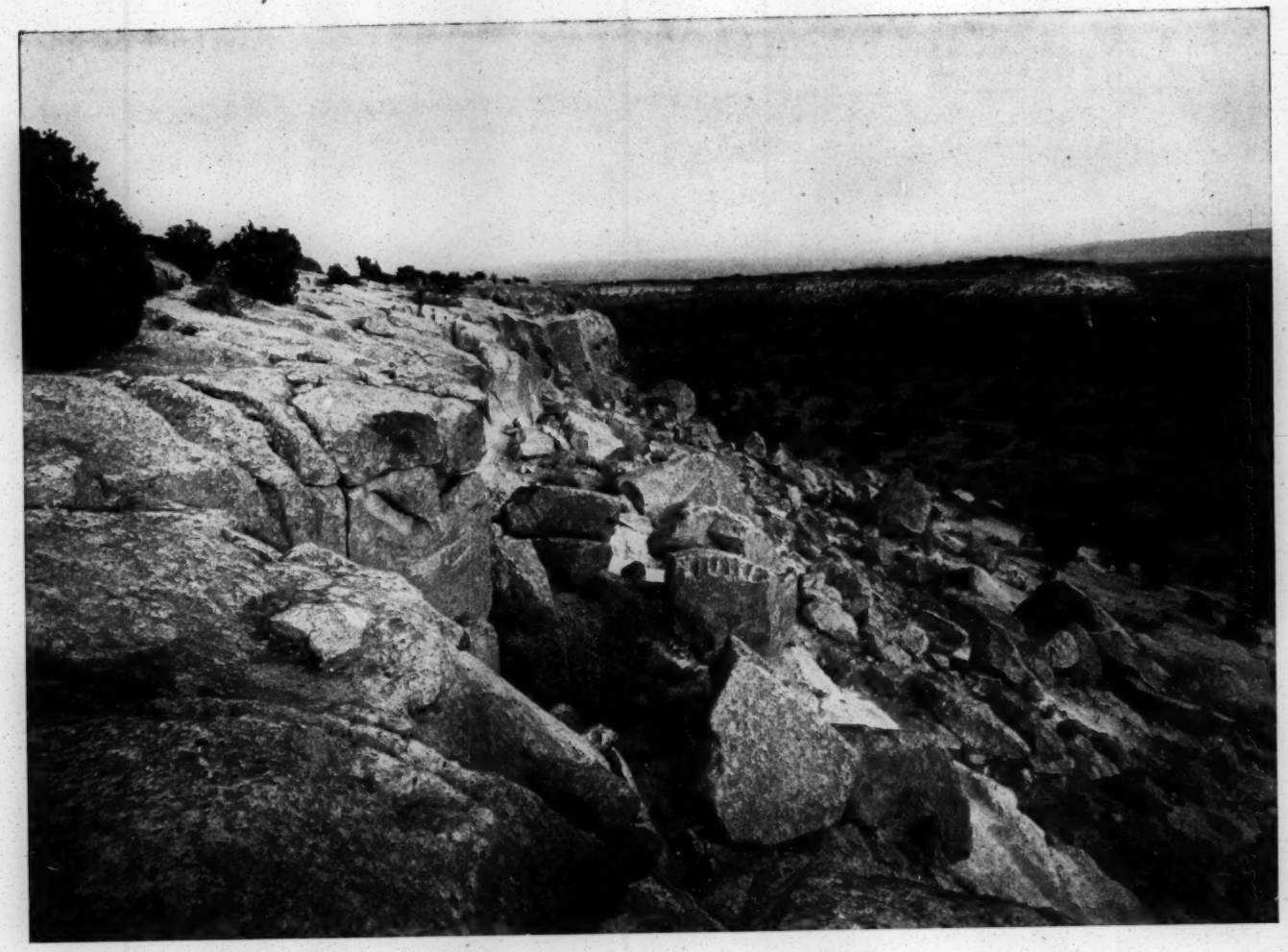
AMONG the several groups of cliff and cave dwellings in northern New Mexico which have been but recently brought to general notice, the most picturesquely situated is undoubtedly the village named by the Pueblo Indians "Tsankawi"—the equivalent in the Tewa language for "The Place of the Round Cactus."

This remarkable ruin is located about thirty miles northwest of Santa Fe, on the Pajarito Plateau, being reached from Buckman, a station on the Denver and Rio Grande Railroad between the former point and Espanola. At Buckman there is a substantial wagon bridge across the waters of the Rio Grande, and back over the mesa seven miles (the first two of which are consumed in ascending the steep side of the table-land from the river to the rim) is located the saw-mill of the Ramon Land and Lumber Company, which owns the great Ramon-Vigil Land Grant, containing many thousand acres of fine timber. From the saw-mill it is possible to make most interesting excursions in many directions among the ruins of the ancient habitations, many of which are in the immediate vicinity of the camp—in fact, the workmen have in some cases taken possession of the Cliff Dwellers' abodes for their present necessities.

Heading for Tsankawi, an hour's drive in a northeasterly direction brings one to the base of a long, irregular-shaped mesa, the sides of which are strewn with great sharp-edged rocks—the volcanic tufa which prevails throughout the region. On approaching this



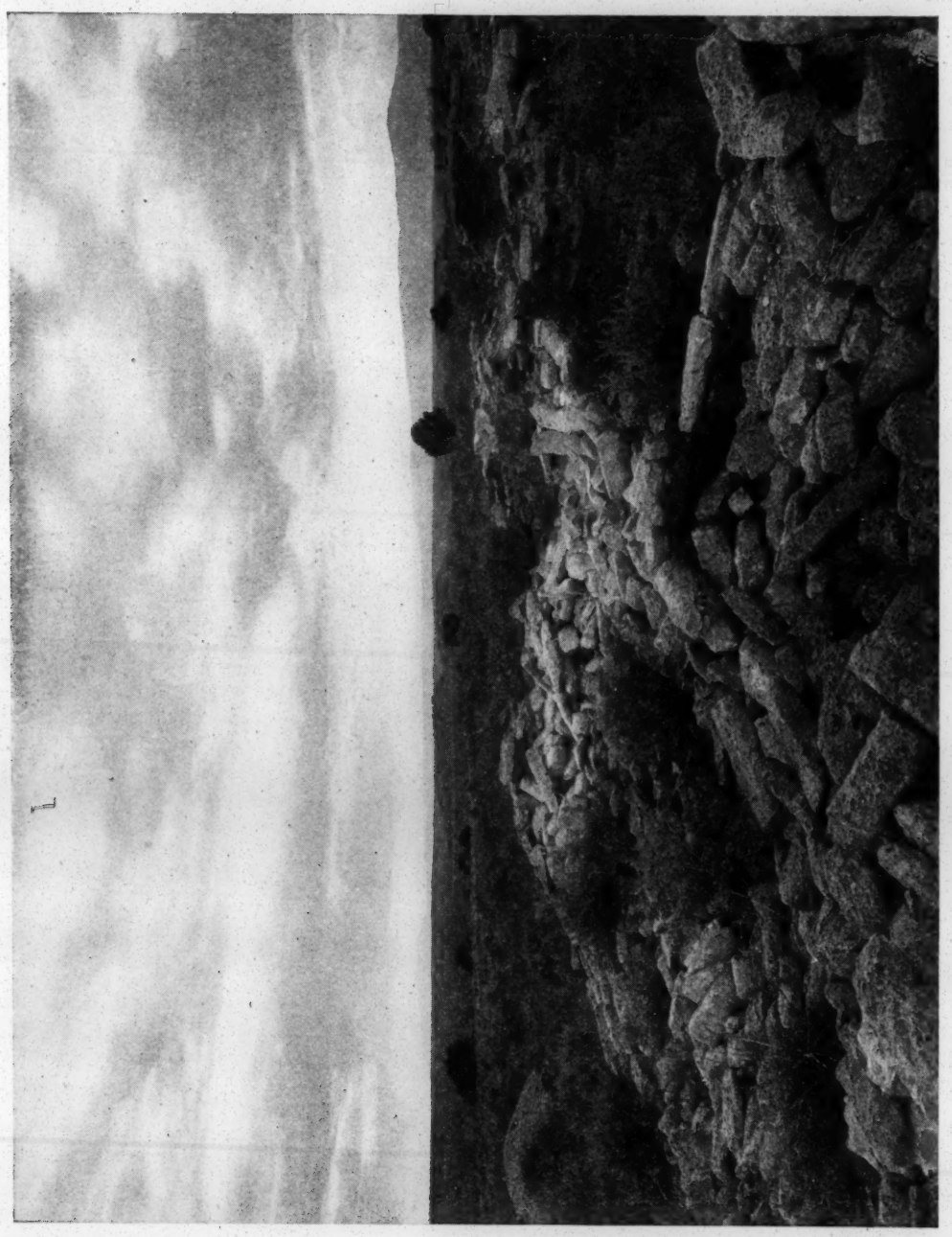
ON THE MESA APPROACHING TSANKAWI, SHOWING SMALLER CITADEL-LIKE MESA IN THE DISTANCE
Ancient path in foreground worn one foot deep in the solid rock



VIEW ALONG THE EDGE OF THE UPPER MESA OF TSANKAWI, SHOWING HOW THE ROCKS HAVE BECOME DETACHED AND FALLEN FROM THE SIDE

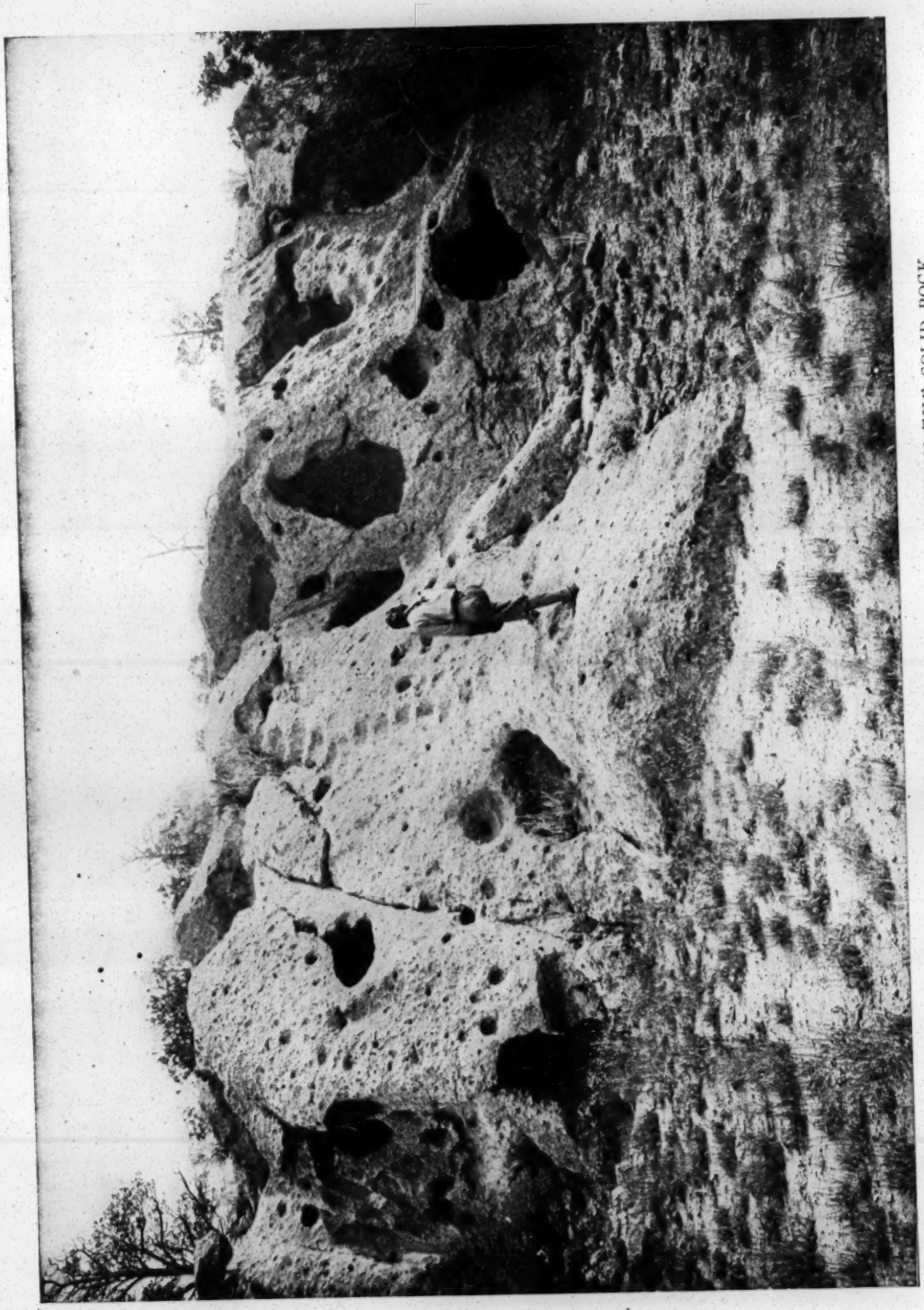
Some of their cutting is shown on large rock near center. Indian standing above passageway

PETROGLYPHS AT TSANKAWI AND ANCIENT PASSAGEWAY TO THE TOP OF UPPER MESA, WHERE ARE FOUND THE RUINS OF THEIR STONE DWELLINGS



RUINS OF ANCIENT PUEBLO ON UPPER MESA OF TSANKAWI

Looking westward; Jemez range in the distance. Very little excavation has been done here. Some graves have been opened at the left



NAVAWI, SHOWING CAVE DWELLINGS AND STEPS CUT IN THE SOLID ROCK
The town now called Navawi (Place of the Game Trap) is a close neighbor to Tsankawi

mesa from the west still another, but smaller, eminence is seen perched upon the larger, probably a thousand feet from its western extremity, occupying a most commanding position and forming a natural citadel.

As one advances, the caves on the sides of the mesa, created partly by erosion and partly by human labor, become more numerous, and upon reaching the summit of the first mesa a well-defined path is discovered, worn in places fully one foot deep in the solid rock by the constant tread of sandaled feet. To have accomplished this, the wearing process must have been carried on for a long period of time by a population of many hundreds—in fact, two of the most remarkable features in connection with these ruins are the enormous number of the dwellings and the evidence of continuous occupation for a great length of time.

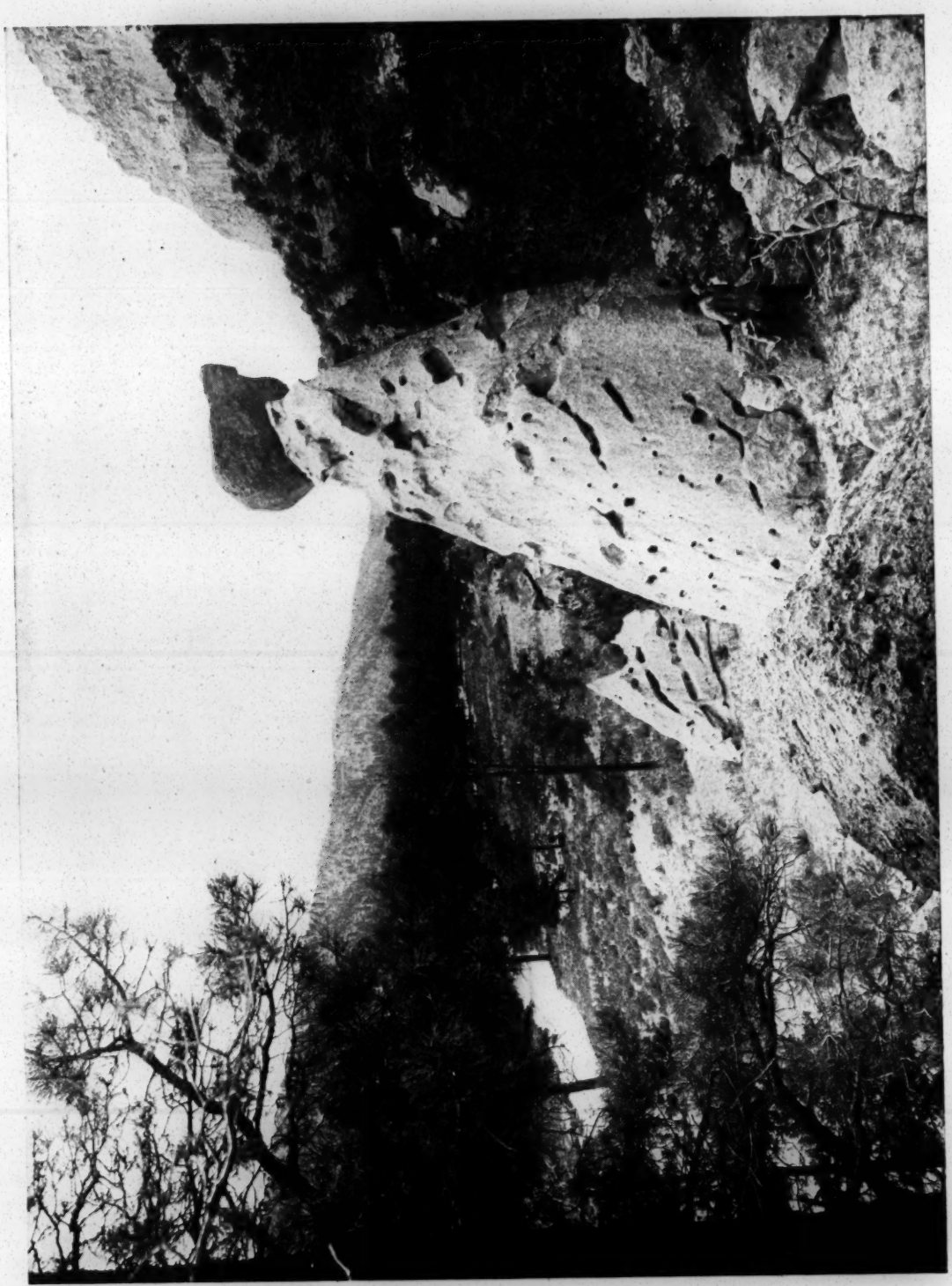
Following this trail, placing one's feet in the depression made in those bygone days, one is led to a great confusion of broken rocks, which appear to have been evidently shaken down from the sides of the upper mesa. Proceeding closer to the wall, the explorer is confronted by a large and most forbidding group of petroglyphs, or rock-cut pictures, representing human beings and animals in threatening attitudes, the principal figure having a substantial tomahawk in its hand. There can be no question that these rude carvings, which are cut to a depth of an inch or more, were so placed in order to frighten enemies away from the narrow passage which is located but a few feet further on, leading to the top of the mesa.

When one enters this passageway the almost impregnable character of the natural citadel above becomes still more apparent. The opening is about ten feet high, two feet wide at the base, and three feet at the top. Immediately after entering the cleft, a slight turn is made to one side, then several more turns in quick succession, and after a climb of perhaps twenty feet up a gradual incline (there are no steps at this entrance) the top of the upper mesa is reached. Perhaps nowhere in the cliff-dwelling region is there a better evidence of this ancient people's capacity for well-directed and persistent labor than is afforded by this very skillfully made passageway, hewn out of the solid rock with their crude tools—axes and hammers of granite, flint, or obsidian.

From the top of the upper mesa a most magnificent view of the great Pajarito Plateau, with its valleys, mountains, and cañons, is afforded, and one is still more impressed with the appreciation of the grand and the beautiful, which seems to have been second nature with these primitive people in the selection of sites for their dwelling-places. Westward is to be seen the Jemez range of mountains; far to the east is the Santa Fe range, while much nearer may be seen portions of the Rio Grande as it flows southward to the Gulf; and in the immediate vicinity are numerous mesas similar to that of Tsankawi, with deep cañons between. The entire landscape, viewed in any direction, is most impressive.

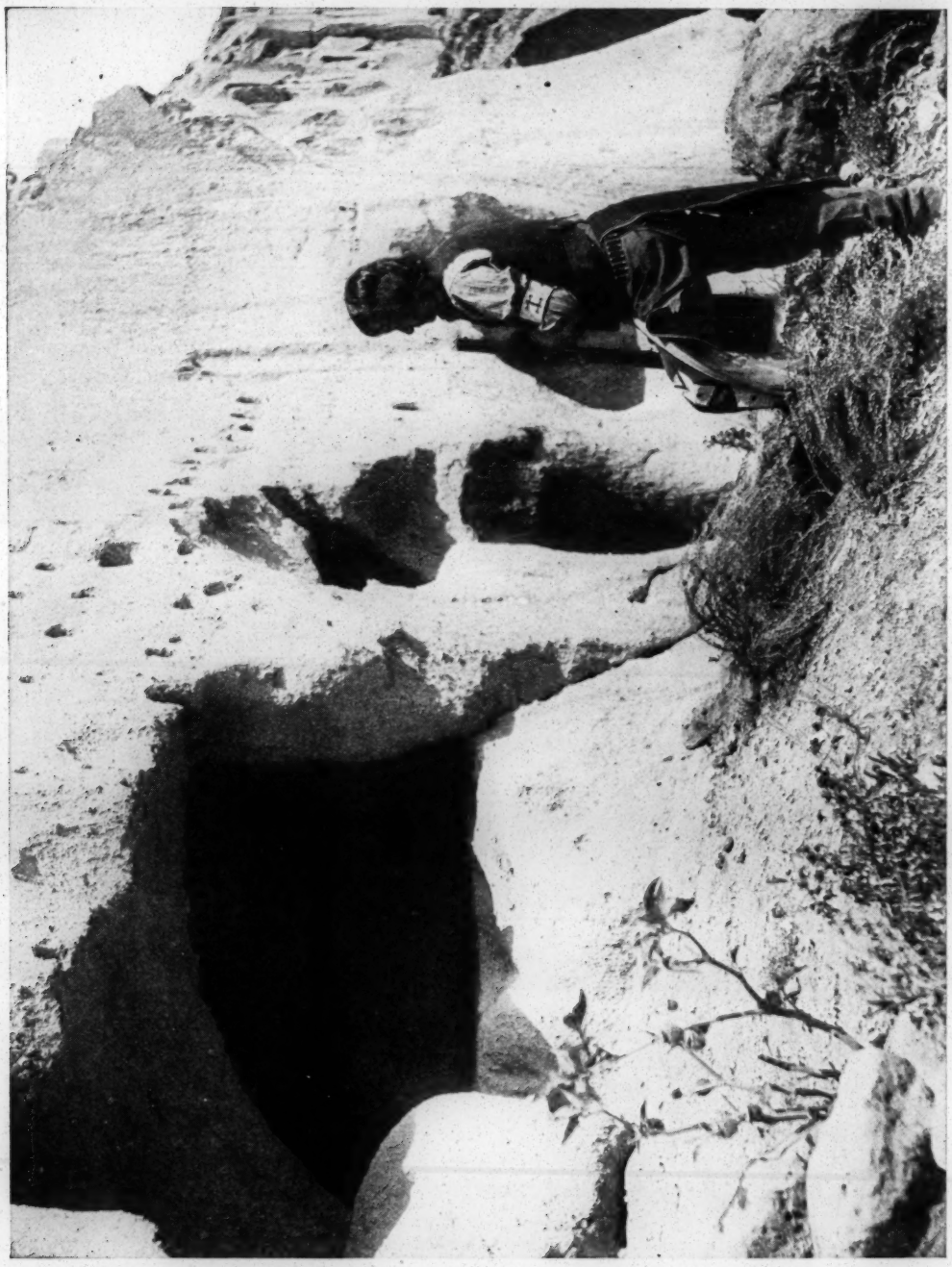
From the upper extremity of the passageway a path leads to the eastward for another thousand feet along the mesa, which grows gradually narrower until it suddenly widens out, and the ruins of the great pueblo (or mesa dwelling, as distinguished from the cave dwellings on the sides below) are presented to the view. Here the almost total destruction of all evidences of habitation forces upon one the conviction that the abandonment of the Cliff Dwellers' homes was due to some terrible calamity. Perhaps their fierce and implacable enemies (for such they must have been, considering the extraordinary means taken for protection), attacking in great numbers, overcame the sentries at the several stairs and passageways, swarmed up to the stronghold above, and massacred the inhabitants or drove them over the cliffs to the larger mesa below. Again, possibly an earthquake or volcanic disturbance forced them to abandon the homes which their forefathers had so firmly established many generations before.

AMONG THE WONDERFUL TENT ROCKS OF OTOWI, A NEIGHBORING TOWN TO TSANKAWI
Some of these cone-shaped formations were hollowed out and used as dwellings by the ancient inhabitants



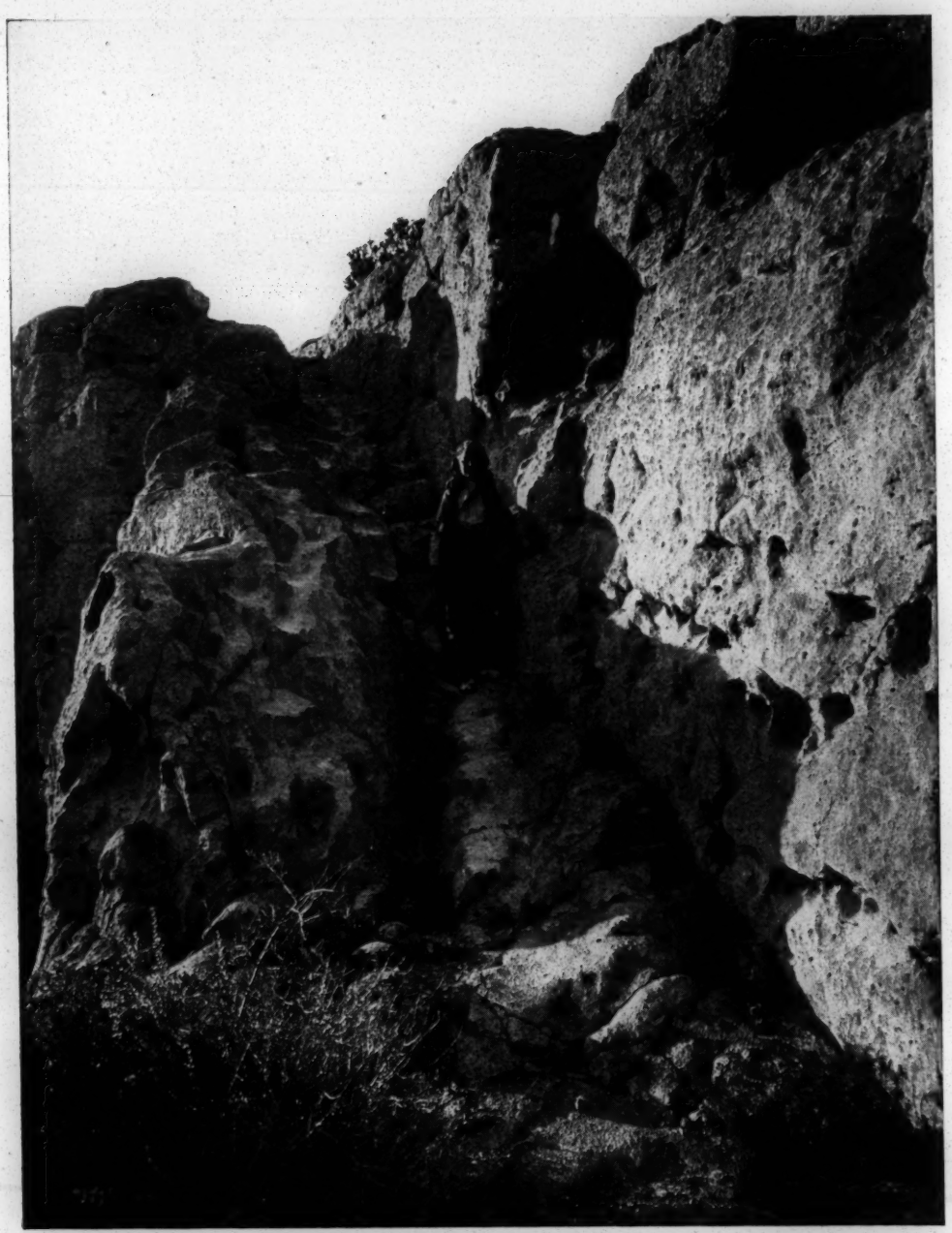
ANOTHER VIEW OF OTOWI, SHOWING SOME OF THE STRANGE TENT ROCKS
The cliff at upper right hand contained many cave dwellings

A FEW OF THE CAVE DWELLINGS AT OTOWI

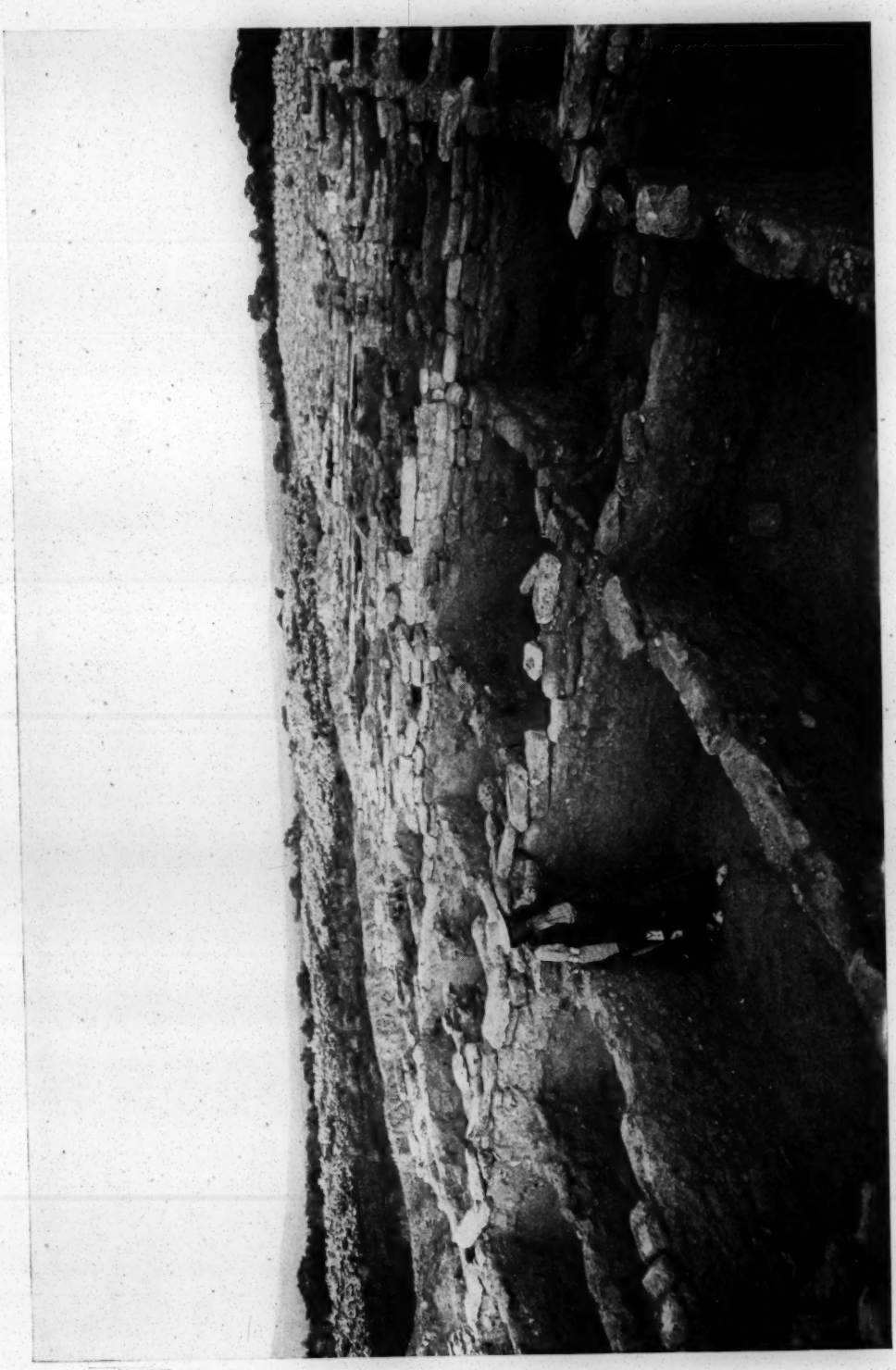


"AT THE HOME OF HIS FOREFATHERS." SHOWING A SANTA CLARA INDIAN BEFORE THE RUINS OF PUYÉ

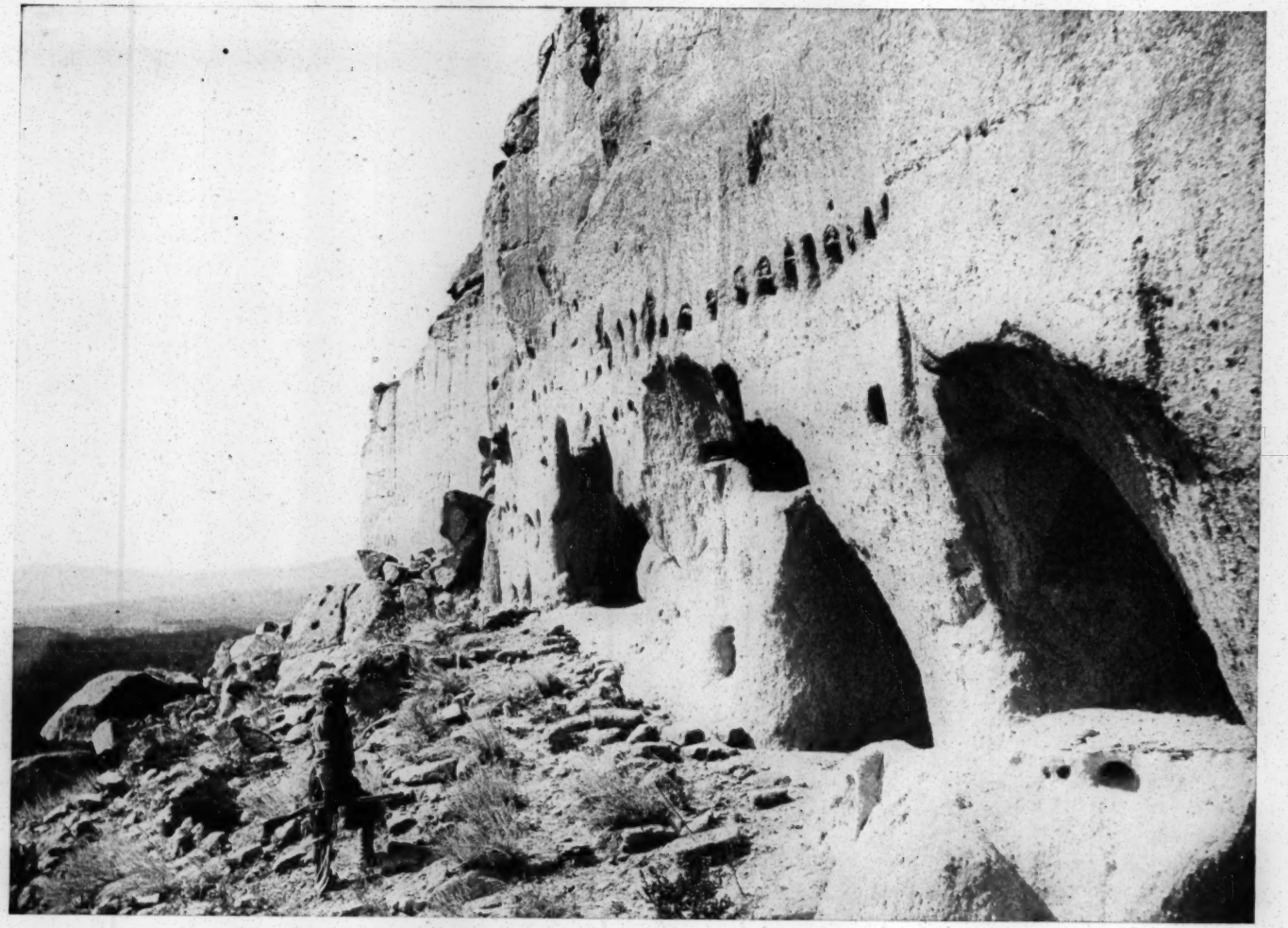
The Santa Claras have a tradition that they are descended from these unknown people



PUYÉ: ANCIENT STAIRWAY LEADING TO THE GREAT RUINS ON THE MESA ABOVE
The steps worn by the sandaled feet of the prehistoric inhabitants are clearly shown



RUINS OF PUEBLO ON TOP OF MESA AT PUYÉ, SHOWING A PORTION OF THE EXCAVATION WORK CONDUCTED BY PROFESSOR HEWETT



PUYÉ, SHOWING A FEW OF THE PREHISTORIC CAVE DWELLINGS

They extend along the side of the mesa for more than a mile. The rooms still show plastering. The small holes undoubtedly held the ends of logs used for balconies, etc. A few carvings are shown at top

The regularly hewn stones of which the houses were constructed still lie in great heaps, probably almost as they were left at the time of the exodus, as very little excavation has been done in this particular ruin. Where the debris has been cleared away at all, the walls are found to be standing for only a few feet above the first floor. The arrangement was in the customary quadrilateral form, with court in the center 150 to 200 feet across, and with outlets at two opposite corners of the enclosure.

There were probably 200 rooms on the ground floor; adding two floors above this one (each somewhat smaller than its predecessor) would make a structure of perhaps 400 rooms. Fragments of pottery and arrowheads are easily found in the ruins, particularly in the vicinity of the graves, some of which have been opened in recent years. Undoubtedly a thorough excavation would reveal many skeletons, or mummified bodies, as well as interesting relics in the form of tools, household utensils, etc.

Among the many other prehistoric ruins in this interesting region should be mentioned Tsankawi's nearest neighbors, Navawi and Otowi, as doubtless the ancient inhabitants were constantly passing back and forth between their respective towns, the former being one and one-half miles to the south and the latter two miles to the west, while a few miles farther away is the Pajarito, or Tschirege ("Little Bird"), ruin. There is no doubt that in prehistoric times, throughout this region, which is now almost utterly wild and uninhabited, could be seen a very numerous population industriously engaged in the common occupation, agriculture, in which some skill is evidenced by the finding of the remains or irrigating ditches, reservoirs, etc.

Each of these ruins seems to have its own characteristics. For instance, at Navawi ("Place of the Game Trap") is found a pit cut in the solid rock for the purpose of capturing deer, bear, and the like, it being a bottle-shaped excavation, about six feet long and three feet wide at the top and fifteen feet deep. This is located on the top of the mesa toward one end, and is reached by four well-worn paths.

At the village in Otowi Cañon the wonderful "Tent Rocks" comprise the distinctive feature. In this vicinity there are probably fifty of these cone-shaped, porous formations of tufa, about one-half of them bearing on the pinnacle a stone of another kind. Some of these Tent Rocks were excavated by the ancient people and used as dwelling-places, the interior walls still showing the prehistoric plaster.

Ten miles to the north and reached from Espanola Station is Puyé, another great ruin. Here there is a most excellent stairway from the cave dwellings on the side of the mesa to the ruins above, where important excavations were conducted recently by Prof. Edgar L. Hewett, Director of the Archæological Institute of America. It is estimated that there were upwards of 500 rooms on the ground floor, and about 100 of these, forming one side of the rectangular arrangement, have been excavated, exposing almost intact the walls of the first floor. Much pottery and many *metates* and *manos* (stones for grinding corn) were found, as well as a number of skeletons.

What became of the Cliff Dwellers, and are there any descendants living at the present day? These questions naturally present themselves to every one who becomes at all interested in the subject. Numerous theories have been advanced, but probably the sanest is that put forth by Professor Hewett in his "Antiquities of the Jemez Plateau." His conclusion (based on known facts as well as tribal traditions) is that the Cliff Dwellers of this region abandoned their homes on the mesas from six to eight hundred years ago and moved to the valleys, where they became scattered and eventually lost their identity, the tribes being finally swallowed up in those of the present Pueblo Indians, among whom scientists have been able occasionally to find descendants with the "long head" peculiar to the skeletons found in the Cliff Dwellings.

These few are undoubtedly the only

representatives now living of the tribes who had made such advancement in the industries and had attained to such vast numbers in the great southwest hundreds of years before the arrival of Columbus in the New World. However, the work is to be continued, and it is altogether probable that more extensive excavations and researches will bring to light additional facts hitherto undreamed of. Certain it is that the subject is a most fascinating one, and the great interest recently awakened cannot but be productive of valuable results.

HIDDEN PERILS OF THE DEEP *

By G. R. Putnam, U. S. Coast and Geodetic Survey

NAUTICAL charts are known to have been in use since the thirteenth century A. D., but systematic surveying and chart-making date back little more than a century, and most of the information shown on modern charts has been gathered in that time. Of the total area of the earth's surface nearly three-fourths, or about 145,000,000 square statute miles, is occupied by the oceans.

The charting of this immense area, and particularly of the great lengths of coast line and of the island and reef-strewn portions, is evidently a work of magnitude. To aid in this work is an obligation resting upon all maritime nations, not only for the benefit of their own commerce, but for the common good of the world. At present many of these nations have made or are extending and perfecting the surveys of their own coasts, and a number of them are adding to the general knowledge of the hydrography of the seas.

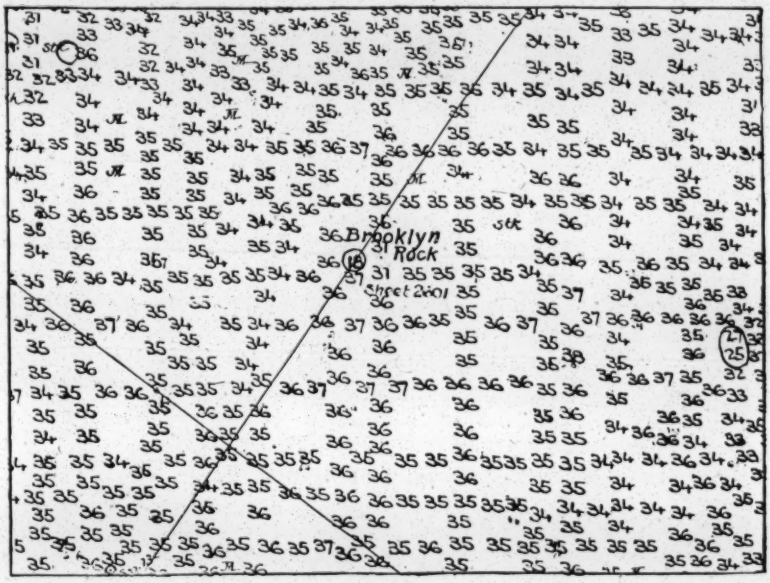
Great Britain especially has done an immense work in improving the charts of many parts of the world. About eighteen nations are publishing nautical charts, and it is estimated that a million copies are issued annually. The British series includes 3,725 different charts, covering practically all oceans and coasts.

Notwithstanding the amount of work done and the number of charts now published, but a comparatively small portion of the continental borders and of the waters of the oceans can be considered as completely surveyed at the present time. Parts of the coasts have been simply sketched by passing vessels, and other areas have been surveyed rapidly to get the information for a preliminary chart. In some cases the original surveys were made to a standard and scale to meet the reasonable requirements of the time, but without counting on the needs of the future, depending on the growth of population, the building of cities, and the changes in the trend of trade.

TREMENDOUS INCREASE IN THE SIZE OF STEAMERS NECESSITATES NEW CHARTS

With the increase of commerce and of the speed of vessels, more direct routes are demanded for reasons of economy. Inside passages not originally used are sometimes developed for defensive reasons. The average draft of the larger vessels has also increased remarkably since the modern hydrographic surveys were commenced, and surveys once made to insure safety for the deepest vessels of that time are no longer adequate. The average loaded draft of the 20 largest steamships of the world has increased as follows: 1848, 19 feet; 1873, 24 feet; 1898, 29 feet; 1903, 32 feet. The average length of these vessels was 230 feet in 1848, 390 feet in 1873, 541 feet in 1898,

* This article is in the main taken from the book "Nautical Charts," by G. R. Putnam, published by John Wiley and Sons, New York, 1908. Most of the illustrative material is from the work of the U. S. Coast and Geodetic Survey; some of the sketches of Haulover Break are from a paper by F. P. Gulliver.



THE BROOKLYN ROCK IN BUZZARDS BAY, MASSACHUSETTS

Hundreds of soundings were made in the vicinity of this small rock, and yet its presence was never discovered until the cruiser *Brooklyn* struck it in 1902. (This diagram is a portion of the original hydrographic sheet).

and 640 feet in 1903. The number of vessels drawing as much as 26¼ feet rose from 36 in 1902 to 185 in 1904. In 1906 there were 17 vessels afloat drawing 32 feet and upward. There are now two steamers on the Atlantic 790 feet long, 88 feet beam, and 37½ feet draft when fully loaded, and two vessels with a length of about 860 feet are under construction.

THE ROCK ON WHICH THE BROOKLYN STRUCK

Good and reliable charts can be made only from correct surveys. It is said that men are apt to believe anything they see on a map. As to the nautical chart, the mariner is apt to be somewhat more critical, however, and it is well that he is. There is great difficulty in charting thoroughly an invisible surface, such as the bottom of the sea, and but a small part of the navigable waters is surveyed in sufficient detail to be certain of the absence of dangers.

It is obvious that the plan of mapping the sea bottom by dropping a lead at intervals over its hidden surface is far from an ideal one. The lead gives the depth only at the point at which it touches the bottom, and no information as to the space between the casts except such as may be inferred from the relation of successive soundings. In numerous cases, after what was considered a thorough survey of a region had been made, at some later day a pinnacle rock or other danger has been discovered. For instance, a detailed hydrographic survey of Buzzards Bay was made in 1895; the sounding lines were run at intervals of 50 to 100 yards, and 91,000 soundings were made for a single sheet. Within this area the cruiser *Brooklyn* in 1902 struck a rock which was found to have 18 feet over it. (See diagram.) The least depth in the vicinity developed in the original survey was 31 feet.

In 1902 a rock with 27 feet over it, surrounded by depths of 50 feet, was located in the North River, New York Harbor, lying about 400 yards off the Battery, in a position such that vessels

must have been passing over it for many years. Notwithstanding close surveys of the vicinity, it had escaped detection until with increasing draft vessels began to touch it. The steamer *Pilgrim* was damaged in 1884 by striking a rock in the East River lying 350 yards off shore. This rock had but 13 feet over it, surrounded by depths of 30 feet; it was sharp and of small extent and was not found in the first surveys.

SWEEPING THE BOTTOM OF THE SEA

Dragging for dangers has long been resorted to for the investigation of isolated spots. A valuable and successful means has been employed recently of making sure that an area is free from shoals or rocks having less than a certain depth. This is done by dragging through the water a wire from 500 to 1,400 feet long and suspended at the required depth with suitable buoys and weights and kept taut by the angle of pull. If, for instance, the wire is set at a depth of 30 feet, it will indicate the presence of any obstruction of less depth by catching on it and upsetting the buoys, and such spots are at once marked and investigated. Considerable work has been done with such drags in the last few years on the Great Lakes and on the Atlantic and Gulf coasts of the United States.

This is of course a somewhat tedious process and gives no information as to depths greater than that for which the wire is set, but the experience already had indicates its great value. It will probably be found desirable in time thus to drag all water areas important to navigation where the depth is near the draft of vessels and the irregular nature of the bottom gives indication of dangers. In extensive dragging operations near Key West and in Jericho Bay, Maine, a number of shoals have been picked up which were not found in the original surveys.

A remarkable instance of the value of the drag was the recent discovery of a rock in Blue Hill Bay, on the coast of Maine. This rock has but 7 feet of water over it and is only 6 feet in diameter at the top. It is surrounded by depths of 78 feet, and has a small base from which it rises abruptly. The original survey gave no indication of a danger here, and its existence was not suspected until it was discovered by the wire drag catching on it.

ROCKAWAY BEACH, N. Y., GROWS AT THE RATE OF 8 INCHES A DAY

The making of the survey and the printing of the chart do not complete the problem of the chart-maker. Both nature and man are constantly changing the facts represented on the charts. Breakwaters and jetties are built, and channels and harbors are dredged, and cities and towns grow up.

A comparison of an early chart of New York Harbor, made in 1737, with the present conditions illustrates well the effect of the growth of a community and port on the problem of chart construction. (See page 825.)

Another interesting example is afforded by Galveston Harbor. (See page 826.) Before the adoption, in 1874, of the project for jetties at Galveston Entrance, there was a natural depth of 12 feet on the outer bar; the effect of the jetties and of dredging has been to give a channel depth of about 28 feet.

Great natural agencies are also constantly at work effecting changes in features shown on the charts. The action of currents and waves is continually cutting away or building the shore, particularly on sandy coasts exposed to storms. When surveyed in 1849, Fishing Point on the east coast of Maryland, was but a bend in the shore line. By 1887 it had built out about two miles in a southerly direction, and in 1908 about one mile farther, curving to the westward. Altogether in 60 years this tongue of land has grown out over three miles. (See page 828.)

Between the surveys of 1835 and 1908 Rockaway Beach, near New York, has grown to the westward 3.3 statute miles, pushing Rockaway Inlet before it. (See page 830.) This is at an average rate of 238 feet each year, or nearly 8 inches

CHART OF NEW YORK HARBOR MADE IN 1737

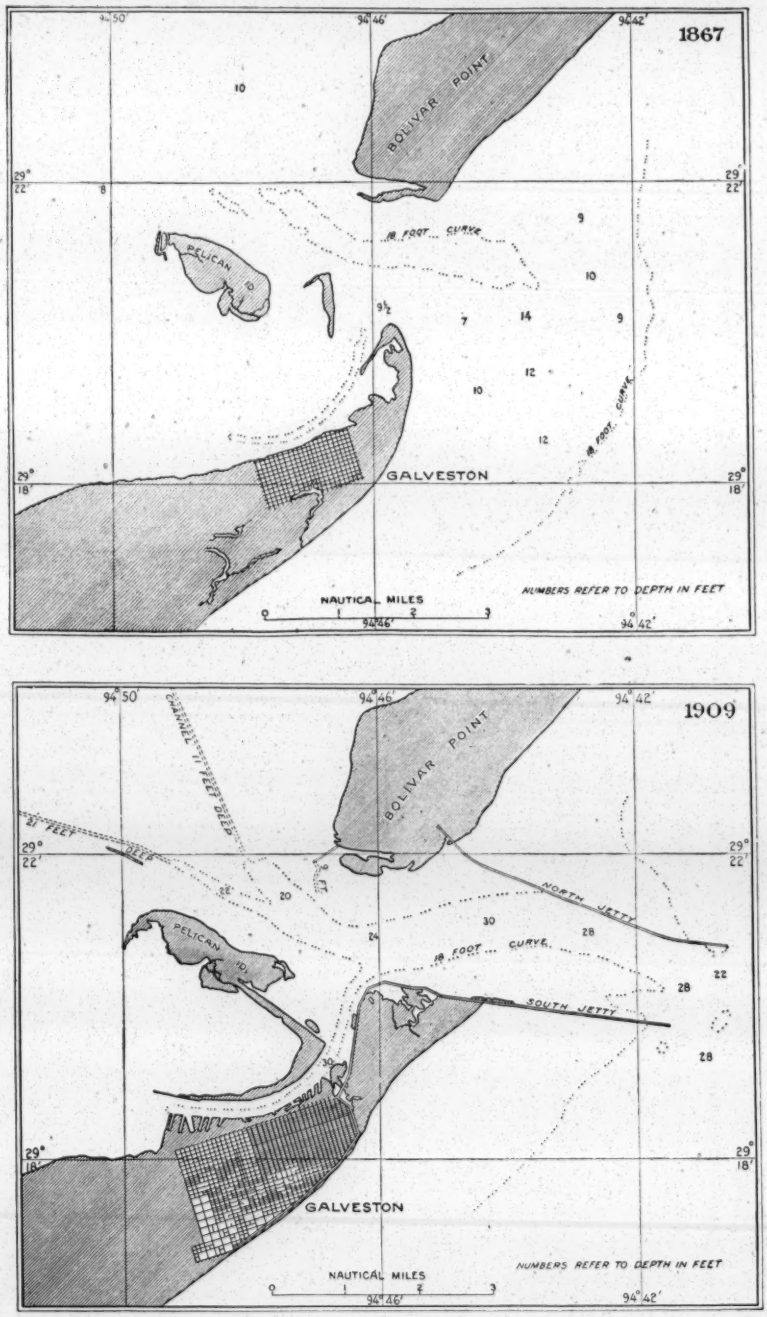
each day. During the same period of 73 years the western end of Coney Island has moved westward less than 0.2 mile.

The Haulover is a narrow strip of land on the eastern side of Nantucket Island, separating Nantucket Harbor from the ocean. This was broken through by the sea in 1896, and after remaining open for 12 years, closed again in 1908 through natural causes. (See page 831.)

Much of the change observed along coasts composed of the softer materials is the cumulative effect of wave and storm action. In some exposed localities channels through shifting materials change rapidly and frequently; so that, no matter how accurate the survey, the chart cannot be depended upon to represent the true conditions for more than a short time. At Fire Island Inlet, Long Island, it is reported that the local boatmen must take soundings two or three times a week for about nine months of the year, and especially after every blow, in order to keep track of the best channel. On the other hand, the great storm at Galveston on September 8, 1900, did not materially affect the available channel depth of 26 feet into that harbor, although the severity of the storm was such as to raise the tide 15 feet above normal, to largely destroy the city, and to cause long breaks in the jetties. This storm cut back the beach 400 to 600 feet in some places and slightly built it out in others, but on the whole had little effect on the charted information.

FIFTY SQUARE MILES OF NEW LAND MADE IN 50 YEARS

Rivers are bearing vast quantities of sediment and depositing these near their



EFFECT OF IMPROVEMENTS AT THE ENTRANCE TO GALVESTON, TEXAS, FROM THE CHARTS OF 1867 AND 1909 (SEE PAGE 824)

mouths, pushing out the cost line and filling in the bottom. The main mouths of the Mississippi are advancing into the Gulf, but at a comparatively slow rate. A break from the main river at Cubits Gap, just above the head of the passes, however, has done an enormous amount of land-making, filling in an area of about 50 square miles between 1852 and 1905. (See page 833.)

The mouth of the Columbia River is an interesting example of remarkable changes of channel and of the movement of an island. Vancouver in 1792 found but one broad channel and no island. The chart of 1851 shows two channels separated by Sand Island, the northern channel being the deeper. In 1851 the center of this island was 3¼ miles southeast of Cape Disappointment, in 1870 it was 2¾ miles southeast, and in 1905 it was 1¼ miles easterly. Since 1851 this island has thus moved 2 miles northwesterly directly across the middle of the river entrance, closing up the northern channel and leaving the river with a single channel, as in Vancouver's time. (See page 834.)

REMARKABLE CHANGES CAUSED BY VOLCANOES AND EARTHQUAKES

Volcanic action in well authenticated cases has caused islands to rise or disappear. In the present location of Bogoslof Island, in Bering Sea, the early voyagers described a "sail rock." In this position in 1796 there arose a high island. In 1883 another island appeared near it. In 1906 a high cone arose between the two, and a continuous island was formed about 2 miles long and 500 feet high. In 1907 this central peak disappeared, and in its place there is at present a bay with from 4 to 25 fathoms of water. Bogoslof is an active volcano, and the main changes have been the result of volcanic action. The history of this island for over a century past forms a remarkable record of violent transformations.

Earthquakes sometimes cause sudden displacements, horizontal or vertical, of sufficient amount to affect the information shown on the charts. A careful investigation of the effects of the earthquake in Yakutat Bay, Alaska, in September, 1899, showed that the shore was raised in some parts with a maximum uplift of 47 feet and depressed in other parts, and that at least two reefs and four islets were raised in the water area where none appeared before. Undoubtedly there were changes in the water depths, but definite information is lacking because there had been no previous hydrographic survey.

The San Francisco earthquake of 1906 caused little vertical displacement, but there were horizontal changes of relative position as much as 16 feet; so far as known, this earthquake did not affect the practical accuracy of the charts. The Italian government recently announced that the terrible Messina earthquake of 1908 has had no effect on the navigability of the Straits of Messina.

Related to earthquake phenomena are the gradual coast movements of elevation or subsidence which are taking place, but at so slow a rate as not to sensibly affect the charts in ordinary intervals of time.

Another agency at work is the coral polyp on the coral reefs; although the rate of growth appears to be very slow, the resulting reefs and keys are an important feature in tropical seas.

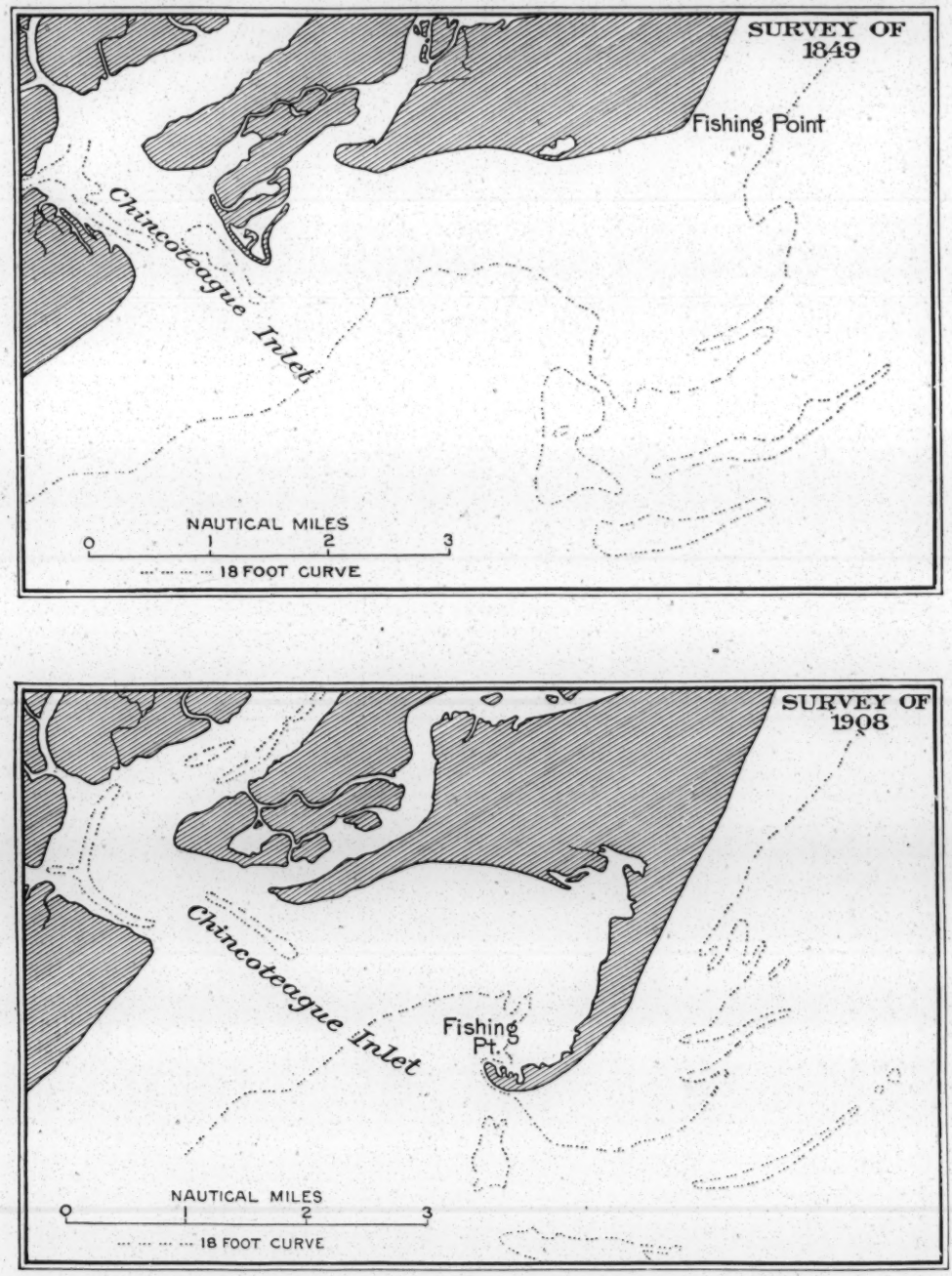
Changes in apparent shore line as shown on the charts are also caused by movements in the fronts of glaciers discharging into the sea. An instance of this is the recession of Muir Glacier in Alaska. As a result Muir Inlet in 1907 extends 7½ miles farther north than in 1895, and a mountain of 1,020 feet elevation on its eastern shore has been uncovered by the departure of the ice.

Practically all the land features shown on charts are likewise subject to changes, the more rapid of which are mainly due to the works of man.

The changes of channels and of commercial needs cause many alterations to be made from time to time in the lights and buoys which are shown on the charts.

KEEPING OUR CHARTS UP TO DATE

The problem of keeping a chart sufficiently up to date is one of much practical importance and one which must be



FISHING POINT, MARYLAND, FROM SURVEYS OF 1849 AND 1908, ILLUSTRATING BUILDING OUT OF A POINT ON THE COAST (SEE PAGE 824)

taken into account in planning what should be shown on the chart in the first place so as to bring it within the range of practicable revision.

Certain features are corrected at once on the charts as soon as the information is received, such as dangers reported and changes in lights and buoys. Where harbor works are in progress the periodic surveys made by the engineers in charge furnish data which are applied promptly to the charts. Reported dangers in channels and bars are investigated by special surveys and the information is put on the charts. Examinations are made from time to time for the revision of the features along the coast line. Complete resurveys have been made, at long intervals, of some important portions of the coast where there has been evidence of change, and these, when they become available, are applied to the charts. All parts of the coast where the exposed portions are not of very permanent material will require resurveys at intervals, depending on their importance and the rate of change.

Notwithstanding the great progress made in hydrographic surveys, a considerable number of rocks and shoals dangerous to navigation and not previously shown on the charts are reported, averaging nearly 400 each year for the last six years, according to the British reports. Of the 367 reported in 1906, 11 were discovered by vessels striking them.

DOUBTFUL OBJECTS ON CHARTS

In addition to the problem of perfecting the charts as respects omissions in earlier surveys and correcting them to show changes which have actually taken place, there is an important task of improvement necessitated by the investigation of doubtful objects which have gotten on the charts and which may have no existence. The uncertainties in many of the earlier positions may be judged by the fact that as late as 1713 the British "commissioners for the discovery of longitude at sea" offered a reward of ten thousand pounds for the discovery of a method of determining the longitude *within 60 miles*. Compensated timepieces, which have been so important a factor in improving navigation, were not invented until about 1761.

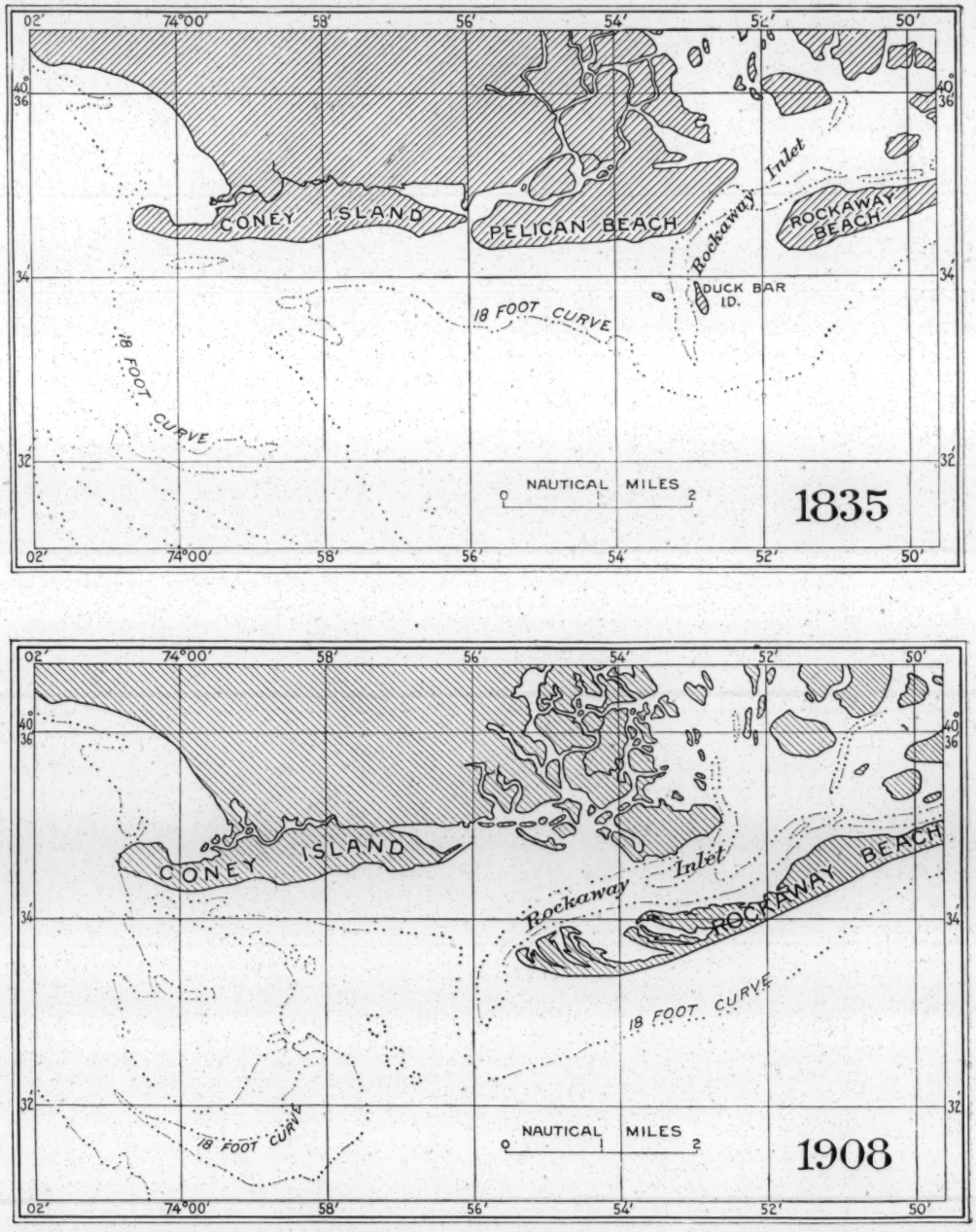
On the earlier charts and on those of more remote regions at the present day much work has been sketched rather than surveyed. Even in the better surveyed portions reports come in as to dangers or other matters not shown, and if of importance and the report appears to be reliable, these are sometimes at once put on the chart pending further investigation, or in other cases an examination is first made.

Shoals, rocks, and even islands have in numerous instances been put on the charts from the reports of passing vessels, without systematic surveys. Many of these no one has been able to find again, and after repeated searches some of them have been removed. The same island or danger has sometimes been charted in two or more different positions as reported at various times. The treatment of such cases is one of the serious and interesting problems of the chart-maker. It is generally less harmful to show a danger which does not exist than to omit one which does exist. On the other hand, a non-existing danger shown on a chart may be the cause of actual expense and loss of time in compelling a vessel needlessly to go out of its course.

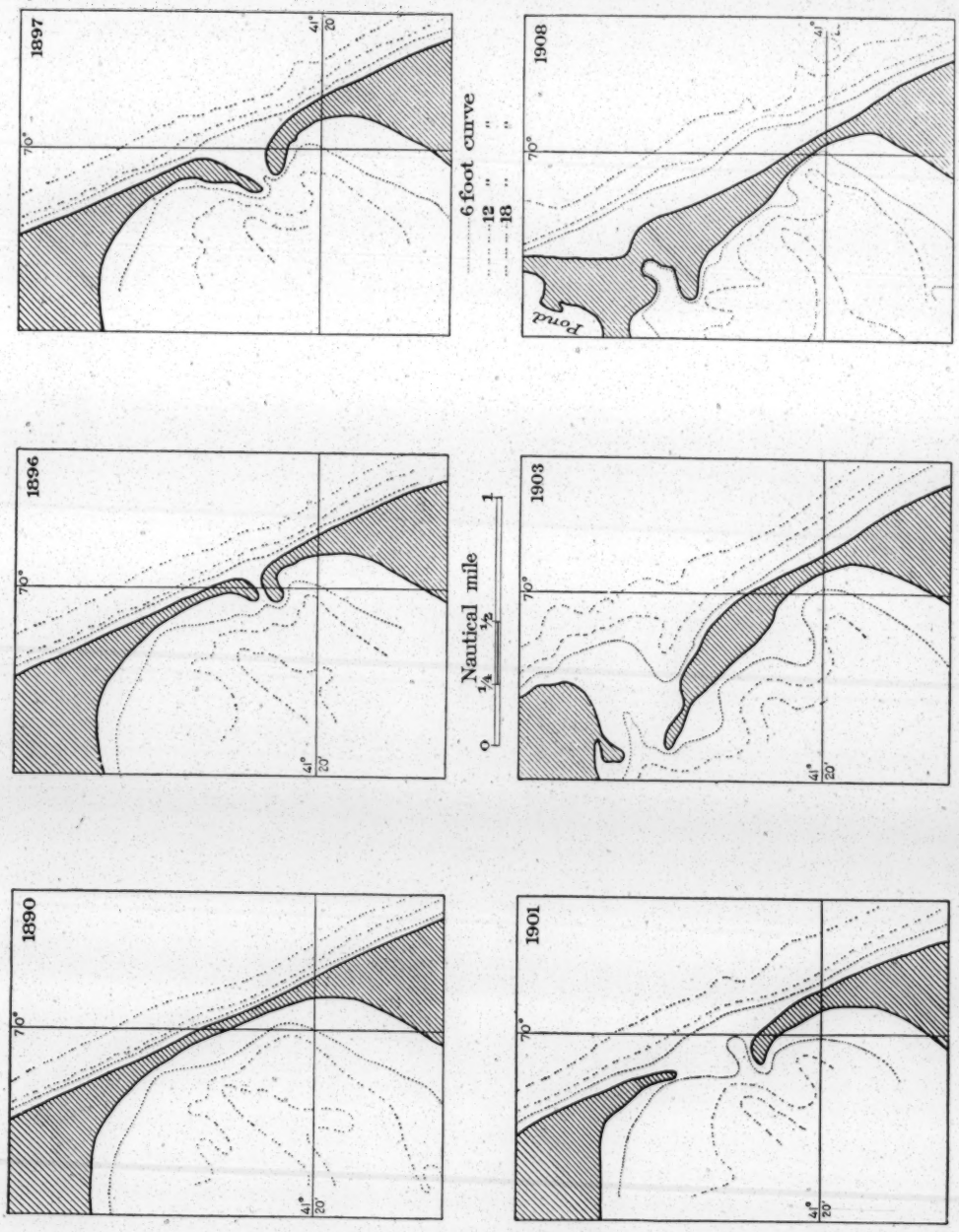
It is surprising to note with what lack of care and of sufficient evidence reports of dangers at sea have sometimes been made, and how incomplete are many of the reports even when the existence of the danger is beyond question. It is unfortunately true that some of these reports are the result of effort to escape blame for accident by throwing the fault on the chart. Many such reports also result from various illusory appearances.

HOW FALSE REPORTS ARE STARTED

A large tree covered with weeds, an overturned iceberg strewn with earth and stones, a floating ice-pan covered with earth, the swollen carcass of a dead whale, a whale with clinging barnacles



MOVEMENT OF ROCKAWAY BEACH AND INLET, LONG ISLAND, FROM 1835 TO 1908
(SEE PAGE 824)



CHANGES IN SHORE OF NANTUCKET ISLAND, MASSACHUSETTS, FROM 1890 TO 1908, SHOWING OPENING AND CLOSING OF THE BREAK THROUGH THE HAULOVER (SEE PAGE 825)

and seaweed, reflections from the clouds, marine animalculæ, vegetable growth, scum, floating volcanic matter, and partially submerged wrecks covered with barnacles have been mistaken for islands, shoals, or reefs.

A school of jumping fish has given the appearance of breakers or caused a sound like surf, and tide rips have often been mistaken for breakers. Raper very properly calls attention to the obligation resting upon every seaman to investigate carefully doubtful cases and to make reliable reports. "Of the dangers to which navigation is exposed none is more formidable than a reef or a shoal in the open sea; not only from the almost certain fate of the ship and her crew that have the misfortune to strike upon it, but also from the anxiety with which the navigation of all vessels, within even a long distance, must be conducted, on account of the uncertainty to which their own reckonings are ever open. No commander of a vessel, therefore, who might meet unexpectedly with any such danger could be excused, except by urgent circumstances, from taking the necessary steps both for ascertaining its true position and for giving a description as complete as a prudent regard to his own safety allowed."

As to the older doubtful dangers now shown on the oceanic charts, it is estimated that the positions may be considered as uncertain by 10 miles in latitude and 30 miles in longitude, and areas of this extent must be searched to determine definitely the question of their existence.

WRECKS THAT CAUSED TROUBLE

The following are interesting or typical cases of reported dangers:

The Spanish steamer *Carmen* was wrecked in 1891 by running on a rock off the southwest coast of Leyte, in the Philippines; the rock was reported to lie one mile off shore, a dangerous position for vessels using Canigao Channel. A survey made in 1903 showed 58 feet of water in this location, and that Carmen Rock, on which the vessel struck, was really within one-fourth mile of the beach. The rock had, however, for twelve years been shown on the charts in a position which made it an obstruction to navigation.

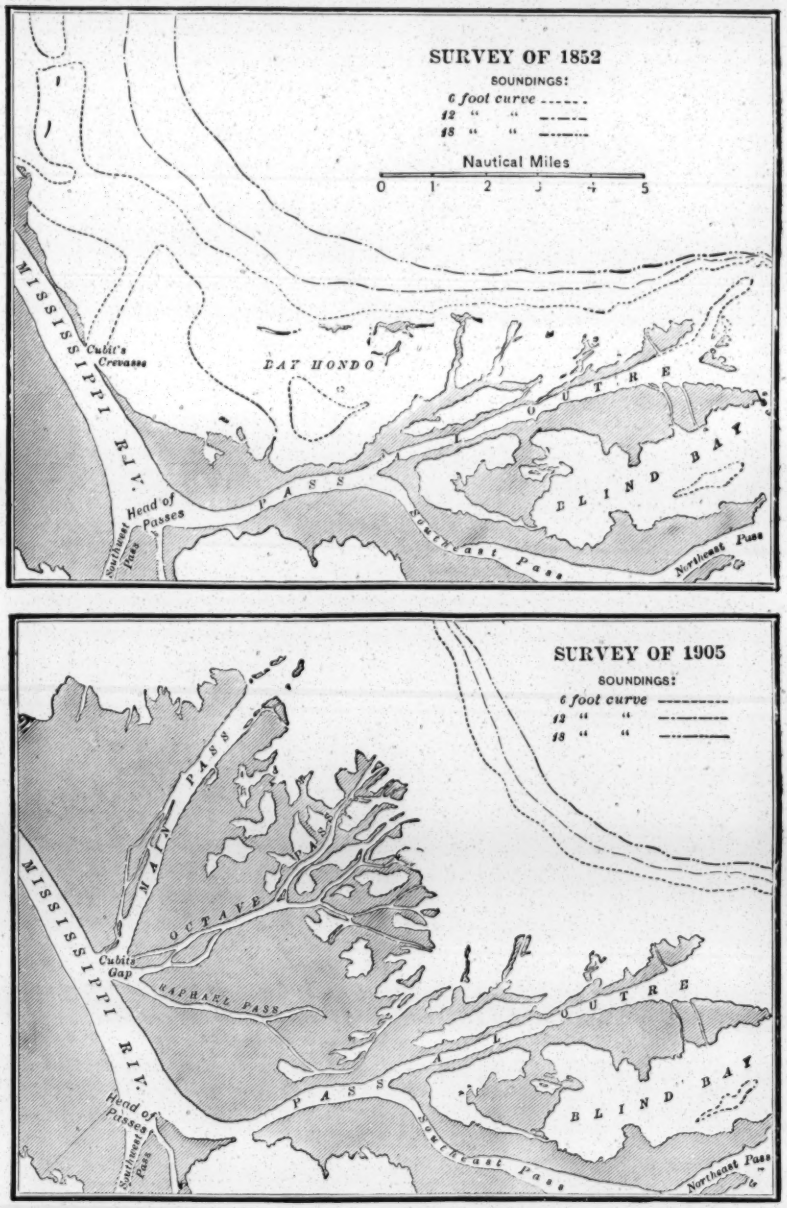
The ship *Minerva* in 1834 was reported to have struck a rock near the middle of the broad entrance to Balayan Bay; the fact that this occurred at 2 a.m. indicated a very doubtful position, but it was stated that an American ship had previously been wrecked on the same rock. It consequently appeared as a danger on the charts for seventy-one years, when a survey showed no depth of less than 190 fathoms in this vicinity, and it was removed from the charts.

A British steamer was wrecked in San Bernardino Strait in 1905. The master reported that he was in a position where the chart showed 51 fathoms, and that he was 1½ miles distant from Calantas Rock, and on these grounds the finding of the official inquiry was that "no blame can be attached to the master, officers, or any of the crew for the casualty." Very shortly after the disaster the surveying steamer *Pathfinder* definitely located the wreck and made a survey of the vicinity. The previous chart of Calantas Reef was found to be fairly correct, and the stranding was determined to have occurred well within this reef, in a position where the chart showed soundings of 3¾ to 4¾ fathoms, and one-half mile from Calantas Rock, which rises 5 feet above high water.

A transport entering San Bernardino Strait a few years ago ran on a rock and was damaged. The position was reported as about two miles southeast of San Bernardino Island and near the middle of the passage. The rock was not put on the charts, as prompt investigation showed 50 fathoms of water in this vicinity, and that in all probability the transport actually touched a small reef making out from the island.

The master of the brig *Helen* reported that his vessel was wrecked on a reef lying six miles from Rockall. When surveyed Helen Reef was found to be about one-third this distance from Rockall.

An island has been reported in eight



GROWTH OF LAND AT CUBITS GAP, MISSISSIPPI DELTA, FROM 1852 TO 1905 (SEE PAGE 827)

COLUMBIA RIVER ENTRANCE, SHOWING MOVEMENT OF SAND ISLAND, AND CHANGES FROM 1792 TO 1905 (SEE PAGE 827)

different positions, ranging in latitude from 30° 29′ to 30° 42′ N. and in longitude from 139° 37′ to 140° 38′ E.

DOUBTFUL ISLANDS

There have been a number of reports of islands in the area from latitude 40° 00′ to 40° 30′ N. and longitude 150° 30′ to 151° 00′ W. The master of the bark *Washington* reported in 1867: "On my passage from the Sandwich Islands to the northwest coast of the United States, when in latitude 40° 00′ N., in a dense fog, I perceived the sea to be discolored. Soundings at first gave great depths, but diminished gradually to 9 fathoms, when through the mist an island was seen, along which I sailed 40 miles. It was covered with birds, and the sea swarmed with seal and sea-elephants." A United States vessel searched in this vicinity without seeing any indication of land, and obtained soundings of 2,600 fathoms. A British ship in 1858 searched for fourteen days over this area without finding anything. Searches were also made in 1860 and 1867 without success, and the present charts show no islands in this part of the Pacific.

In a number of cases erroneous positions have been due simply to blunders. Thus Lots Wife, first seen by Captain Meares in 1788, was shown on his chart in latitude 29° 50′ N., longitude 156° 00′ E., and stated in his book to be in latitude 29° 50′ N. and longitude 142° 23′ E. Massachusetts Island by one report was in longitude 177° 05′ E. and by another in 167° 05′ E. The apparent blunder of 10° is now immaterial, as the island has disappeared from the charts altogether. The Knox Islands were placed by the Wilkes Exploring Expedition in latitude 5° 59′ 15″ N., longitude 172° 02′ 33″ E. The old charts showed islands of this name also in latitude 5° 59′ N., longitude 172° 03′ W., the longitude being doubtless transposed. In the case of Starbuck Island, discovered south of the Equator, the latitude was apparently transposed, as on old charts it was also shown in the position, latitude 5° 40′ N., longitude 156° 55′ W.

A pinnacle rock can sometimes be located only with great difficulty, even when known to exist. Rodger Rock, on which the bark *Ellen* struck and was damaged, lies in latitude 0° 41′ 15″ N. and longitude 107° 31′ E. It has but three feet over it at low tide. The British surveying ship *Rifleman* searched four days before finding it, although the plotted tracks showed that she and her boats had passed very close to it. This indicates that great caution must be used in removing a reported danger from the charts.

A comparison of a Pacific Ocean chart of about forty years ago with one of the present time (see page 836) illustrates in a striking manner how many doubtful dangers, or vigias, have gotten on the charts and how after laborious search many of them have now been removed. This condition was especially true of the Pacific, owing to the numerous reports of an indefinite nature from whaling ships, among whose captains there was a saying "that they do not care where their ship is, so long as there are plenty of whales in sight."

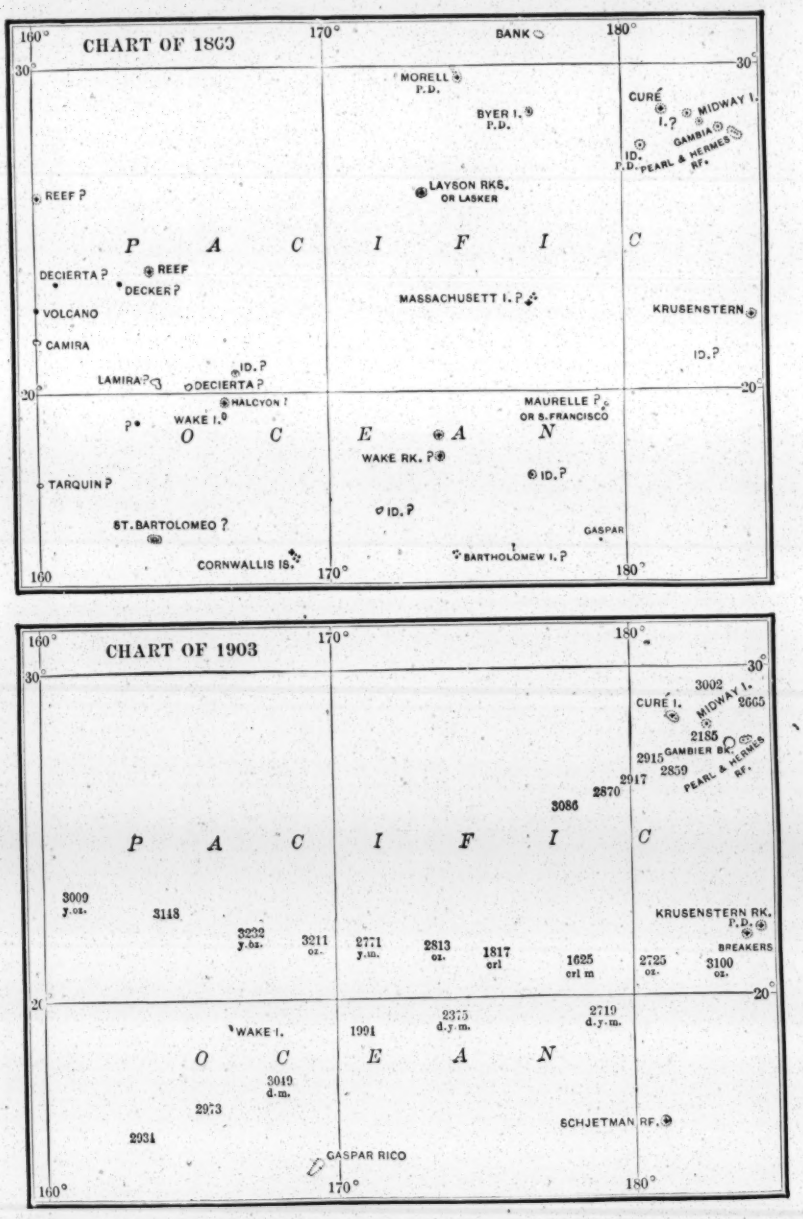
DEATH TRAPS THAT MIGHT HAVE BEEN AVOIDED

That the use of corrected and up-to-date charts is important is illustrated by the following instances, taken from the records of the British courts, showing the results of failure to provide such charts:

In 1890 the steamer *Dunluce* was lost owing to the use of an old edition of the Admiralty chart which showed a depth of 4½ fathoms on the Wikesgrund, whereas the later charts showed much less water.

In 1891 the steamer *Trent* was lost on the Missipezza Rock, in the Adriatic. The ship was navigated by a private chart, published in 1890, which did not show this rock, and by sailing directions published in 1866.

The steamer *Aboraca*, stranded in the Gulf of Bothnia in 1894, was being navigated by a chart corrected to 1881, which



PORTION OF CHARTS OF 1869 AND 1903, OF THE PACIFIC OCEAN WEST OF THE HAWAIIAN ISLANDS, TO ILLUSTRATE THE REMOVAL OF DOUBTFUL DANGERS

did not show that the Storkallagrund light vessel had been moved eight miles.

The steamer *Ravenspur* was lost on Bilbao Breakwater owing to the use of a chart not up to date, which did not show the breakwater. In 1898 the steamer *Cromarty* was lost in attempting to enter Ponta Delgada Harbor, and in 1901 the steamer *Dinnington* was lost by steaming on to the new breakwater in Portland Harbor; both of these disasters were likewise due to the use of old charts which did not show the breakwaters.

The records of the courts of inquiry also show cases where vessels have been wrecked owing to the use of charts of too small scale.

In 1890 the steamer *Lady Ailsa* was lost on the Plateau du Four. The only chart on board for this locality was a general chart of the Bay of Biscay, and the stranding was due to the master's mistaking one buoy for another. The court found that the chart, although a proper one for general use, was not sufficient for the navigation of a vessel in such narrow waters and on such a dangerous coast.

THE WHEELER NATIONAL MONUMENT

ONE of the late additions to our great system of national parks is the Wheeler National Monument, located in the Rio Grande National Forest, Colorado. The tract included by the President in his proclamation of December 8, 1908, about 300 acres in all, is situated on the south slope and near the summit of the Continental Divide, at an approximate elevation of 11,500 feet. The monument is named in honor of Captain George Montague Wheeler, of the U. S. Engineers, the leader of many surveying and exploring parties of the early 70's, who did much to blaze a way for settlement in that part of the West.

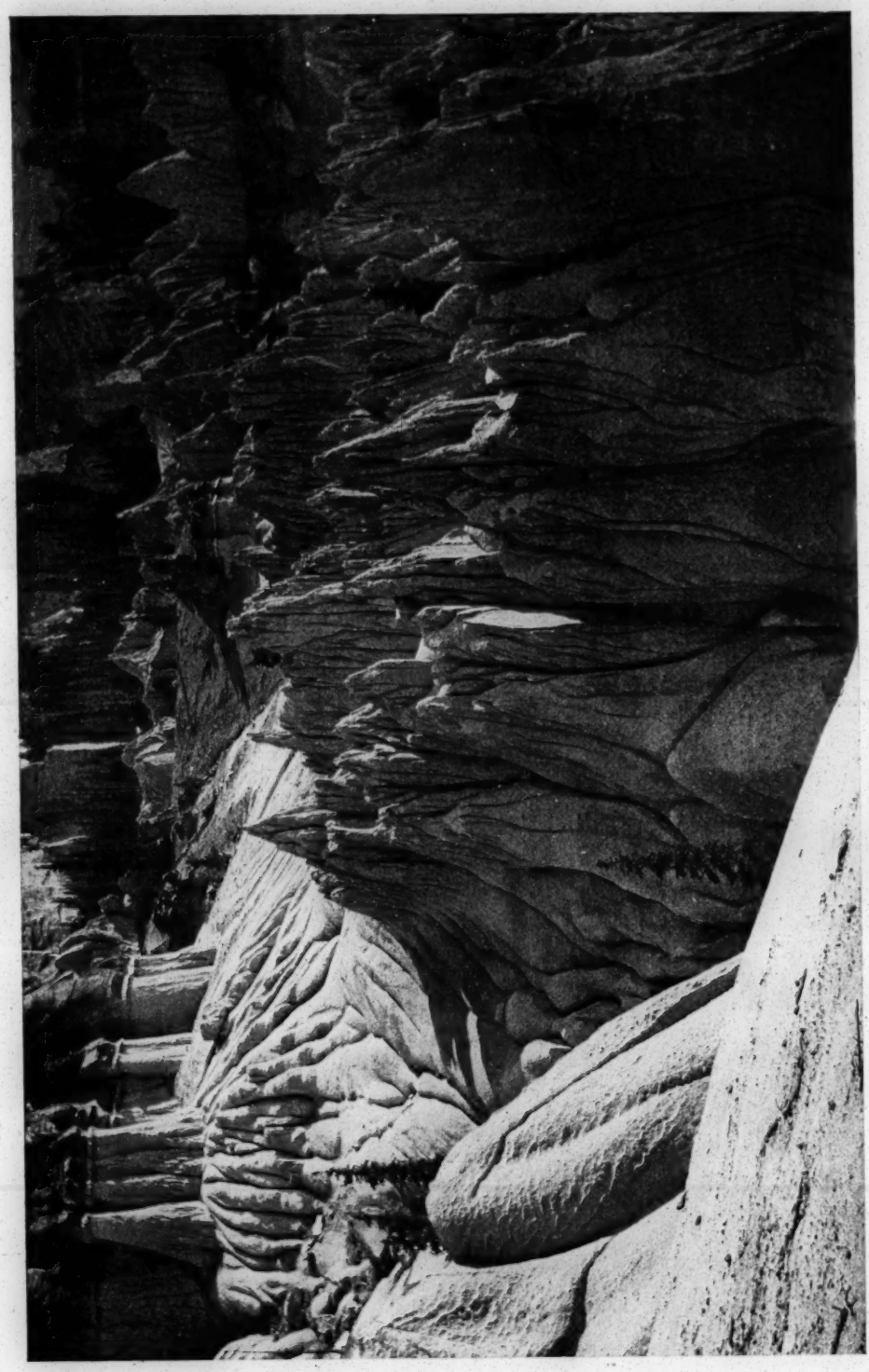
The principal value of the land as a national monument lies in the fact that the fantastic forms resulting from the rapid erosion of rock and soil make the spot one of exceptional beauty. The numerous winding canyons, broken ridges, pinnacles, and buttes form such striking and varied scenes that it will be much visited by tourists when its location becomes more widely known. As a matter of fact it rivals the wondrous Garden of the Gods, about which so much has been written, and is nearly as extensive in area. The towering rock formations, varying in color from a brilliant terra cotta to bright yellow and white, lifting against the wonderful blue of the matchless Colorado sky, and the splendid atmospheric conditions enabling one to see clearly for miles and making objects stand out in striking relief, all count in the sum total of scenic beauty. These lava formations are so strange and fantastic that it does not take a great stretch of imagination to picture the country as the playground of the giants of some prehistoric race.

Historical interest also attaches to the region, as it is believed that the ill-fated expedition of John C. Fremont was overtaken by disaster in this immediate vicinity and was forced to turn back. Skeletons of mules, bits of harness, and camp equipage found near this spot give credence to the belief.

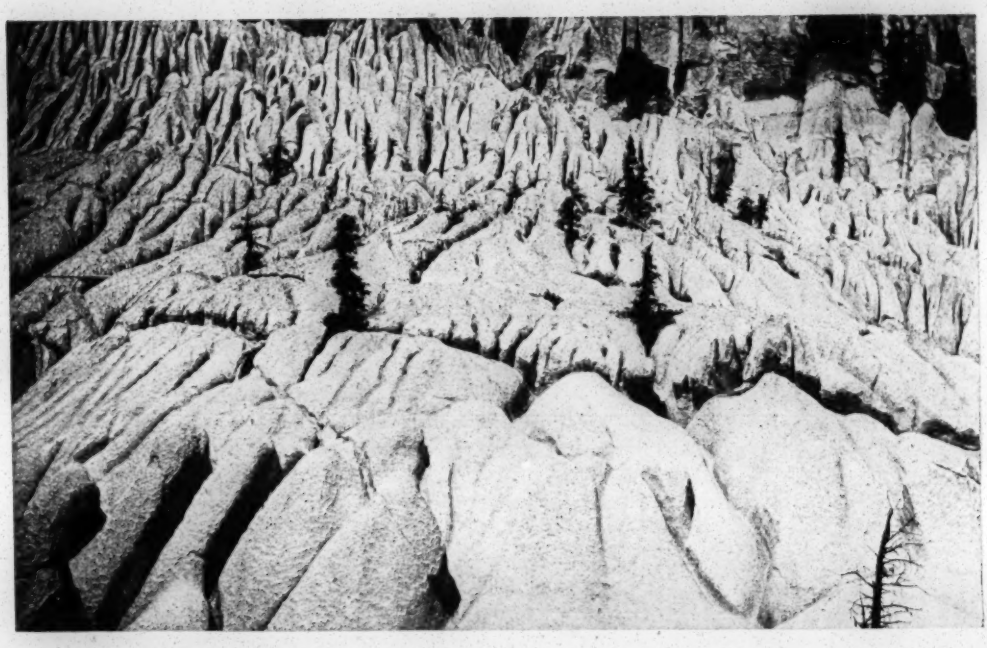
Due to the fact that the reservation is considerably off the beaten track, it is necessary to travel some distance after leaving the Rio Grande Railroad at Wagon Wheel Gap. From that point horses and guides can be readily secured to transport the visitor over the intervening stretch of twenty miles to the reservation, and a more delightful outing could not be had than a few days' camping in this beautiful spot.

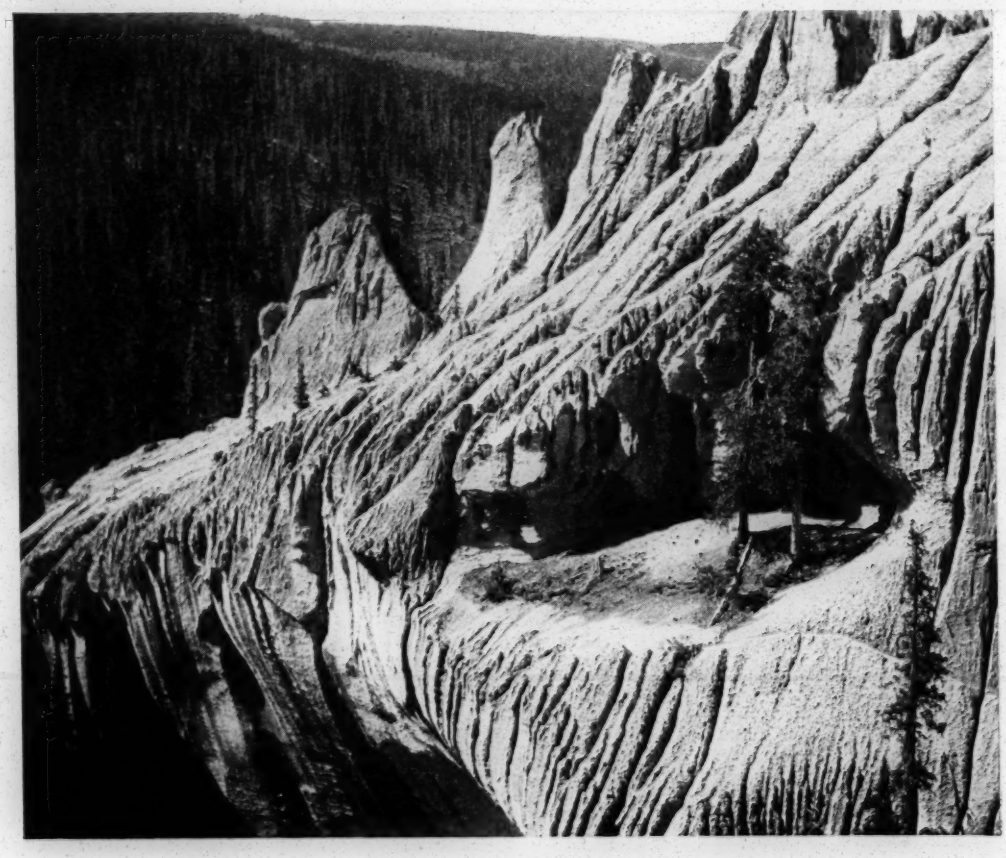
PANORAMA IN THE WHEELER NATIONAL PARK

The picture can only give a suggestion of the wonders of this spot



IN THE FANTASTIC AND MULTICOLORED LAVA FORMATION NATURE HAS GIVEN THE WHEELER NATIONAL MONUMENT A STRIKING AND BEAUTIFUL STAGE SETTING





VIEWS OF THE STEEP SLOPES: WHEELER NATIONAL PARK

Waltham Watches

The Waltham Watch Company was the first company in America to make watch movements; the first to be organized (more than half a century ago), and is the first now in the quality and volume of its product.

A book about watches sent on request.

Waltham Watch Company
Waltham, Mass.

Every Step in Picture Making by the

KODAK METHOD

is at Your Convenience.

The Kodak loads and unloads in full daylight.

The Kodak Film Tank will develop your films in full daylight — with better results than the old way.

You can make your own prints by any light on Velox.

NO DARK-ROOM

For any part of the work.

Ask your dealer or let us send you copies of our booklets "Tank Development" and the "Velox Book."

Eastman Kodak Co.
ROCHESTER, N. Y.
The Kodak City.

OF INTEREST

to Publishers, Booksellers, Authors, and all others who intend to get out books containing color work, fine half-tones, or maps: Write us outlining your proposition and we will send you specimens of work we have done for others and suggestions as to handling yours. We have complete departments for handling every part of the work within our own four walls, which greatly simplifies the matter for you. The specimens of maps and printing, and we are proud of them, will show the quality of our work.

THE
MATTHEWS-NORTHRUP
WORKS
BUFFALO, N. Y.

BOSTON OFFICE
221 Columbus Avenue
NEW YORK OFFICE
Madison Square Garden Tower
CLEVELAND OFFICE
Citizens Building

A 6% bond secured by Long Island real estate, purchased under direction of the **Dean Alvord Company** to be held for appreciation without development. **Bondholders take half the profit** through the medium of a 50% stock bonus.

Plan of operation follows that of other very successful syndicates under the same management.

Interesting circular on request.

SWARTWOUT & APPENZELLAR
(Members of N. Y. Stock Exchange)
44 PINE ST., NEW YORK

Your courtesy in mentioning the Magazine when writing will be appreciated

YOU SHOULD READ

IN TO THE YUKON

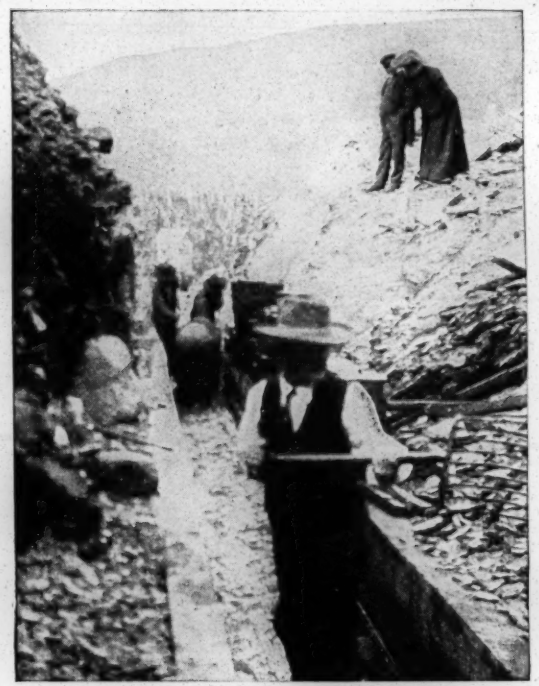
By WILLIAM SEYMOUR EDWARDS

This book was posted in the Carnegie Library high among the honor list of the dozen most called for and frequently read of the year. With the travel northward to the Alaska-Yukon Exposition this book will be valuable to thousands who would know something of the Northwest country.

100 Illustrations *$1.75 Postpaid (U. S.)*

"'In to the Yukon' is a book telling of the great wheat-bearing area, of the gold country, and of other interesting sections of the great Northwest country. ¶ Mr. Edwards' letters show keen insight as well as power of entertaining description."

—*Springfield (Mass.) Republican.*



SLUICING FOR GOLD, OTTER CREEK, B. C.

"One contemplating a tour through the Klondike region can get useful pointers on a summer outing from 'In to the Yukon.' It is a narrative of travel more comprehensive than the title indicates."

—*Boston (Mass.) Advertiser.*

BY THE SAME AUTHOR

On the Mexican Highlands

Illustrated. 12mo, Cloth. $1.75

A most interesting and intimate description of that wonder country, the treasure house of the world, old Mexico, its ancient customs and quaint people.

Through Scandinavia to Moscow

12mo, Illustrated. $1.75, Postpaid

Not to travel at leisure through that part of Europe, so full of romance and legend, with such a delightful writer as Mr. Edwards, is an opportunity lost indeed.

SPECIAL OFFER!

With the knowledge that the readers of the National Geographic Magazine are much interested in books of travel, we make a special price for the three splendid volumes of $5.00, express prepaid.

JENNINGS & GRAHAM, Publishers, Cincinnati, Ohio

Your courtesy in mentioning the Magazine when writing will be appreciated

If You Use Acetylene

This Burner Will INTEREST YOU

THE BRAY ELTA
U. S. Patent 629,061

THE BRAY ELTA BURNER

¶The use of this burner enables the acetylene user to *regulate the size of the flame* at the burner *to best suit* the amount of illumination desired.

¶**THE BRAY ELTA,** if so desired, can be *turned down* to the *merest glimmer without injury to the burner.* When *turned low* the **Bray Elta** *will not smoke or deposit carbon* on the burner tip.

Our Booklet, "ACETYLENE FACTS," would interest you. Write us for a Copy

WILLIAM M. CRANE CO.

16, 18, and 20 W. 32d St. **New York**

Your courtesy in mentioning the Magazine when writing will be appreciated

Classified Advertisements

COMBINES DIGNITY, DIRECTNESS AND A MINIMUM OF EXPENSE

For Terms, address . . . . Advertising Manager
The National Geographic Magazine, Washington, D. C.

ENGINEERING EXPERTS—MINING, MECHANICAL, ELECTRICAL, CIVIL

LEE LATROBE BATEMAN, Consulting Engineer. 20 years' experience, Farming Specialist, Irrigation, Drainage, and Reclamations. Surveys and reports made on projected developments. Special Field—Louisiana and Texas Gulf Coast Region. **Address, 55 West Eighty-second St., New York City.**

H. B. GOODRICH, Consulting Geologist. Specialty: Oil, Gas, and Coal. Sixteen years' experience as geologist. Ten years in examination of oil propositions in Canada, Mexico, and the United States, and practical management of drilling, development, and oil production in Canada, Texas, and Oklahoma. Address: 66 Chester Street, Allston, Mass.

WM. GRIFFITH, Consulting Mining Engineer and Geologist. Specialty: Economic Geology, Mining of Coal. Careful Examinations and Reports on Coal, Mineral Lands and Mines Anywhere. Interviews by Appointment, Eastern Cities. **Coal Exchange, Scranton, Pa.**

WILLIAM J. ELMENDORF, Mining Engineer. 20 years' experience in responsible positions. Consultation with owners on operation. Candid reports to buyers or sellers. No promotion. References gladly furnished. **Box 1039, Spokane, Washington**

ASSOCIATED ENGINEERS COMPANY
Consulting and Supervising Engineers
417 Century Building
17th and Stout Streets **Denver, Colorado.**

A FINE COLLECTION of selected, perfect specimens of Arrow Heads and Drills; also Bird Stones, Pipes, Hammers, Scrapers, Implements, Plummets, Sinkers, Pendants, Ornaments, Banner Stones, Pierced Tablets, etc. All mounted on mission-finished panels suitable to hang in library or den. Price, $350.00. Address, **Chas. W. Marvin's Art Store . . . Findlay, Ohio**

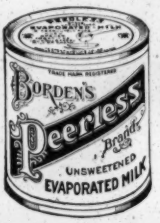
All the plates used in
The NATIONAL GEOGRAPHIC MAGAZINE
are made by
The GILL Engraving Company
140 Fifth Avenue New York

One Experience

of the Satisfactory Results obtained from

BORDEN'S PEERLESS BRAND EVAPORATED MILK

(Unsweetened)



and you will always have a supply in your house. Perfectly adaptable to all kinds of cooking.

Rich in Cream and Absolutely Pure.

BORDEN'S CONDENSED MILK CO.
"Leaders of Quality"
Est. 1857 **NEW YORK**

HIGGINS' { AMERICAN DRAWING INKS

The kind you are sure to use with continuous satisfaction

AT DEALERS GENERALLY

Chas. M. Higgins & Co.
Manufacturers
271 Ninth St., Brooklyn, N. Y.

BRANCHES: Chicago, London

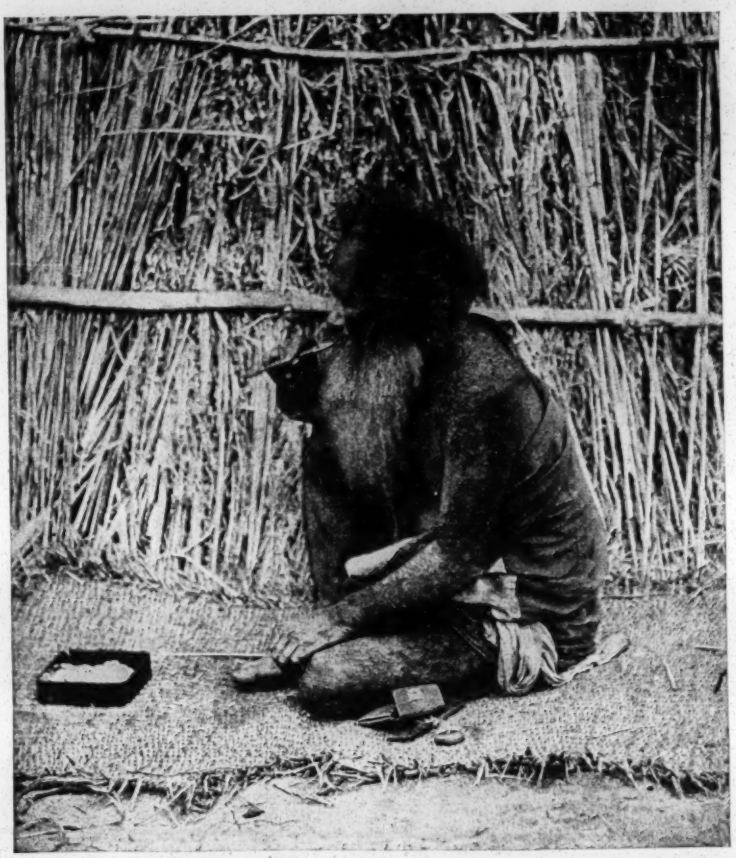
Coal and Coke Development

From Survey to Completion

Examinations and Reports

J. TONER BARR
CIVIL AND MINING ENGINEER
237 Fourth Avenue, PITTSBURG

Your courtesy in mentioning the Magazine when writing will be appreciated



A HAIRY MAN OF THE AINU TRIBE, JAPAN
PHOTO FROM "SCENES FROM EVERY LAND," SECOND SERIES

IN view of the LIMITED EDITION of the Second Series of "SCENES FROM EVERY LAND," you should send in your order at once. We are unable to supply copies of the first series. The entire edition was exhausted long ago, and several thousand members who did not order in advance found copies could not be obtained later. By filling out this order blank at once and mailing it to the Society with your remittance, you will avoid any such disappointment with the Second Series. No reservations will be made unless a remittance accompanies the order.

CUT ON THIS LINE

NATIONAL GEOGRAPHIC SOCIETY,
WASHINGTON, D. C.

_____, 1909.

Please reserve for me_____copies of "Second Series, SCENES FROM EVERY LAND," bound in_____, for which I enclose herewith_____dollars.

NAME_____

STREET ADDRESS_____

CITY AND STATE_____

Bound in Red Cloth, $1.00
Bound in Leather, $2.00, De Luxe Edition

9-'09

A FEAST OF UNCOOKED FLESH

PHOTO FROM "SCENES FROM EVERY LAND," SECOND SERIES

The Andorobs, a nomadic and mongrel race, who roam the dense forests and unfrequented plateaux of East Africa, live entirely by the chase and eat raw the flesh of their kill.

SAFETY *and* ISOLATION *with* ECONOMY *and* MOTOR EFFICIENCY

are features that every automobile owner using gasoline should consider. THE AIR-TIGHT STEEL TANK placed underground furnishes a blanket form of insurance covering these points and many more.

Air-tight Steel Tanks for Automobiles, Motor Boats, etc., PLACED UNDERGROUND

provide the safest, most economical, and convenient means of storing gasoline underground known; though the tank is isolated, the supply is always at hand. A few strokes of the pump and a steady flow is started—stopped instantly by opening a pet cock—**No waste, No dripping, No risk.**

The gasoline, which can be bought at wholesale at a considerable saving in price, is always at its original strength, furnishing more miles to the gallon than does gasoline that has deteriorated through evaporation caused by poor storage facilities.

AIR-TIGHT STEEL TANKS are made of heavy 3-16-inch steel, brazed without rivet or solder, by an honest process that we have successfully employed for the past 20 years in manufacturing tanks for the largest railroad systems in the world.

AIR-TIGHT STEEL TANKS are sold on a 30 days' trial with an absolute *money-back guarantee.* We pay the freight.

Write for illustrated booklet. FREE.

AIR-TIGHT STEEL TANK CO., 414 Wood St., Pittsburgh

FIRE LIGHTNING WIND-STORM

The Home Insurance Co.

NEW YORK

ORGANIZED 1853 ELBRIDGE G. SNOW, President

Main Offices: 56 CEDAR STREET

CASH CAPITAL, $3,000,000

ASSETS January 1, 1909	$24,856,499.05
LIABILITIES (Including Capital)	14,173,677.54
RESERVE AS A CONFLAGRATION SURPLUS	800,000.00
NET SURPLUS (Over All Liabilities and Reserves)	9,882,821.51
SURPLUS AS REGARDS POLICY-HOLDERS	13,682,821.51
Losses Paid Since Organization Over	115,000,000.00

When you pay for protection get that which is **ABSOLUTELY SURE**, no matter how many conflagrations happen anywhere.

Property Owners, Mortgagees, Executors, and Trustees desiring the best and surest Insurance will appreciate the fact that the net assets of THE HOME—the surplus funds reserved for the exclusive protection of its policy-holders—are greater than those of any other Fire Insurance Company operating in this Country.

TOURIST-BAGGAGE AUTOMOBILE

IN THE EYES OF THREE NATIONS

Rand McNally & Company are pleased to offer the American public a most unusual combination—the world and its countries as seen by England, Germany, America. Depicted by the best map makers these nations can furnish, the subjects present an interest tripled by the viewpoints.

THE STANFORD MAPS

solely represented by Rand McNally & Company, are works of Edward Stanford, London, England, Geographer to His Majesty the King. Especially designed for school use, the Stanford Large Series of School Wall Maps, the New Orographical Series of Wall Maps, and the Library Maps are notably good and particularly commended to your attention.

KIEPERT'S CLASSICAL MAPS

also offered through the exclusive agency of Rand McNally & Company, are productions of the greatest German Map House—that of Deitrich Reimer. In their delineation of ancient Persia, Greece, Rome, Britain, they are not only the highest form of graphic art, but they are indispensable aids to the study of geography and history in schools, universities, and libraries.

THE RAND McNALLY MAPS

leaders in America for fifty years, are unrivaled by the product of any other house. They are not only admirable and various in subject-matter, but examples of cartographic art rare in excellence. School-room and commercial world are alike amply provided for. For schools the Columbia, the Physical, and the Bird's-eye Series of Wall Maps are extensively used and sought. . . . Write for further information.

RAND McNALLY & COMPANY

CHICAGO NEW YORK

AROUND THE WORLD

COOK'S 38th Annual Series of

TOURS de LUXE

Cover varied routes, including Japan, North China, South China, Java, Korea, Manchuria, Manila, Burma, Ceylon, Siam, India, Egypt.

Highest-class travel, best hotels, small limited parties, complete sightseeing, advance arrangements made by our own Oriental offices. Long experience makes our service finest possible. Westbound Tours leave San Francisco Oct. 5, Oct. 20; Eastbound leave New York Nov. 6, 27, Dec. 9, Jan. 8. Fall Tour to EGYPT, the NILE, and PALESTINE from New York by S. S. "Caronia," Nov. 27.

THOS. COOK & SON

New York, Boston, Philadelphia, Chicago, San Francisco, Montreal, Toronto, and 140 offices abroad

Cook's Travellers' Cheques Good All Over the World

WHERE TO GO NEXT WINTER—SUMMER

NEW ZEALAND, the Greater Switzerland! When the northern hemisphere is blanketed with snow New Zealand is at its best, with a perfect climate and natural wonders that rival the world's greatest; and on the way there one sails over summer seas to the enchanted islands of Tahiti and Rarotonga, etc. January 15th the midsummer cruise to MILFORD SOUND is made; nothing like it for scenery and genuine adventure.

TAHITI AND BACK (24 days), $125, First class. Sailings September 11, October 17, November 22.

WELLINGTON AND BACK, $260, First class, 44 days (meals and berth).

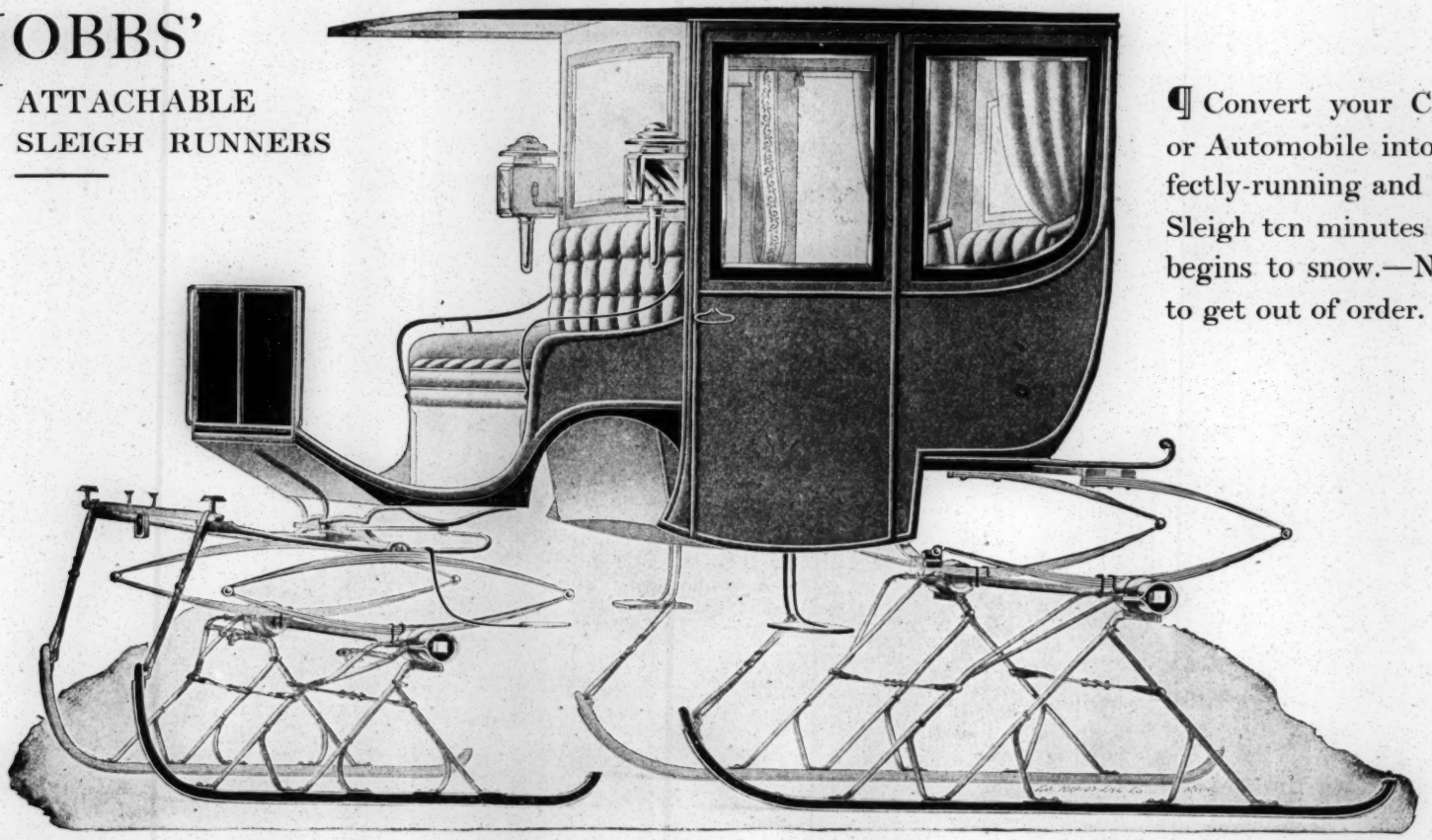
SOUTH SEA ISLANDS (all of them), 3 months' tour, Tahiti, Rarotonga, New Zealand, Tonga, Samoa, Fiji, and Hawaii, $400 (November 22, including MILFORD SOUND, $488.75). Write for Itineraries to

Oceanic Steamship Co., 673 Market St., San Francisco, Cal.

Your courtesy in mentioning the Magazine when writing will be appreciated

HOBBS'

ATTACHABLE SLEIGH RUNNERS



¶ Convert your Carriage or Automobile into a Perfectly-running and Stylish Sleigh ten minutes after it begins to snow.—Nothing to get out of order.

¶ WHY BUY A SLEIGH, that must be stored most of the year and offers a fair mark for moth and rust, when at a small cost you can convert any carriage into the easiest-running sleigh in the world—IN TEN MINUTES, by removing the wheels and substituting my patent single runners? Note the superior length of runners and the rods connecting each pair, which make such long runners practical. They do not mar or injure the carriage in any way, simply become for the time you wish to use them as much a part of the carriage as the wheels and as perfectly secure. The runners can be interchanged with the forward wheels of an automobile in the same manner, and as they are made to track any width, they go anywhere a sleigh can travel; these runners must track the same as the wheels. By permission, I can refer to forty perfectly satisfied customers, who have two hundred carriages equipped with my runners. ¶ Write at once for prices and measurement blanks, so you can be ready for winter and can in ten minutes turn your carriage or automobile into a perfect-running sleigh. Address, JOHN E. HOBBS, North Berwick, Maine

To the Thousands of Business Men who Read The National Geographic Magazine—*a Word*

¶ Read what a few of our advertisers say about the space they use.

¶ Experience is the best teacher; why not profit by theirs?

THE WASHINGTON LOAN & TRUST CO.

WASHINGTON, D. C.

ADVERTISING DEPT.,
NATIONAL GEOGRAPHIC MAGAZINE,
WASHINGTON, D. C.

GENTLEMEN: No doubt it will interest your Advertising Department to know that this company has received a considerable number of new accounts of marked size and importance resulting directly from our advertisement in the NATIONAL GEOGRAPHIC MAGAZINE.

One account of $15,000 came from Alaska, the depositor writing he wishes to open an eastern account, and because he saw our advertisement in your publication he knew we must be an institution of high standing.

It is evident you reach a very large number of wealthy people with money to invest.

Very truly,

(Signed) FREDERICK EICHELBERGER,
Trust Officer.

Temperature Today, 71.

HOTEL DEL CORONADO.

CORONADO BEACH, CAL., *June 2*, 1909.

ADVERTISING DEPARTMENT,
THE NATIONAL GEOGRAPHIC MAGAZINE,
WASHINGTON, D. C.

GENTLEMEN: I desire to express my appreciation and thanks for the good received by the Hotel del Coronado in the short time we carried an advertisement with you last season.

I have found it an exceedingly hard matter to trace definite results from an advertisement, but, from the written inquiries (and the verbal expressions) which we have received, have been convinced you have one of the best advertising mediums in the country, and appeals especially to the class of people to whom we cater.

It is a long time to speak in advance for next fall, but I shall ask, before the beginning of another season, that you duplicate the advertisement for us.

Very truly yours,

MORGAN ROSS, *Manager.*

NEW YORK—CASSELL & CO., PUBLISHERS—LONDON.

NEW YORK.

NATIONAL GEOGRAPHIC MAGAZINE.

GENTLEMEN: I have pleasure in advising you that from our page in your February issue advertising the $12.00 proposition we received exactly twice the number of replies derived from any other medium used that month.

Very truly, CASSELL & CO.,
Publishers.

SECURITY STORAGE COMPANY.

WASHINGTON, D. C.

ADVERTISING MANAGER,
NATIONAL GEOGRAPHIC MAGAZINE,
WASHINGTON, D. C.

DEAR SIR: I am very glad to give expression to my thorough confidence in the GEOGRAPHIC MAGAZINE as an advertising medium for such propositions as we have to present.

It is very rare indeed that we are ever able to trace any direct results from our advertising, but we know of more business being obtained through the GEOGRAPHIC MAGAZINE than that of any other one medium. The officers of the Bowling Green Storage Company—whose advertising was placed in the GEOGRAPHIC MAGAZINE by me—tell me they have received a number of very profitable inquiries from their advertising and they consider it an excellent medium.

Yours very truly,

(Signed) C. A. ASPINWALL,
Vice-President.

TO WHOM IT MAY CONCERN:

From *six pages* of advertising in the NATIONAL GEOGRAPHIC MAGAZINE of the volume entitled "Scenes from Every Land," three pages prior and three pages subsequent to publication, the aggregate orders received directly accruing were *12,000*, at $2.50 and $1.00 each. From the *first page* of advertising, although several months before publication, *1,422* reply orders were received.

(Signed) GILBERT H. GROSVENOR,
Editor.

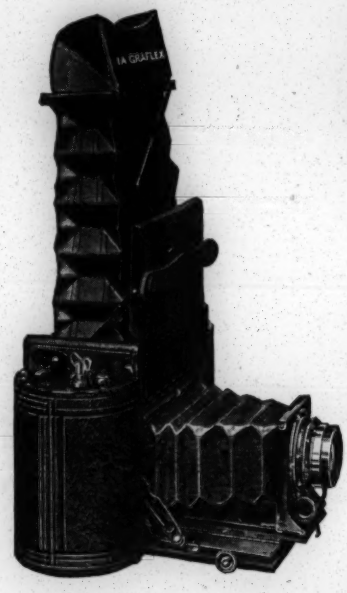
¶ Think what it means to bring your business each month to the attention of 50,000 well-to-do, cultured people in the most personal way possible—by telling them about yourself in *their own magazine.*

¶ Let us tell you the facts relative to the Magazine and the quality of its circulation.

ADVERTISING MANAGER

THE NATIONAL GEOGRAPHIC MAGAZINE, WASHINGTON, D. C.

XUM



THE many advantages of the 1A Graflex render it a particularly valuable camera for the tourist.

¶It uses regular daylight loading Kodak Film for pictures 2½ x 4¼ inches, and is fitted with a focal plane shutter that will make an exposure as brief as 1-1000 of a second, as well as time exposures of any duration. In addition to this, it is fitted with a reflecting mirror and focusing hood that enable the operator to see the image right side up the size it will appear on the negative *up to the instant of exposure*—no necessity for guessing distances—no microscopic "finder."

Price

1A Graflex without lens	$60.00
1-A Graflex with B. & L. Zeiss Tessar Series Ic No. 14, F-4.5	100.50
1A Graflex with Zeiss Kodak Anastigmat No. 2, F-6.3,	82.00
1A Graflex with Cooke Lens Series IV No. 25, F-5.6	98.00

¶Graflex catalog mailed on request.

FOLMER & SCHWING DIVISION
Eastman Kodak Company
ROCHESTER, N. Y.

This Camera is Recommended by the Travel Bureau of the Magazine

The Escape from Worry

Give us a winding road, a sky full of white floating clouds, a river and a bridge over which to rumble, a lake, blue and inviting, among green hills, an hour's run to dinner, and the sense of power and control at the wheel of a Rambler—and we will have no thought of business cares.

With the **Rambler**

there is added to the pleasure of touring the satisfaction of freedom from the worries of the road.

The Rambler Offset Crank-Shaft makes this car silently powerful, capable of running at forty or three miles an hour on high speed, and climbing any hill with gratifying ease.

The Rambler Spare Wheel saves the tiresome task of repairing and pumping up a tire, and can be substituted for the regular wheel within three minutes' time.

RAMBLER AUTOMOBILES, $1,150 to $2,500

Thomas B. Jeffery & Company

Main Office and Factory: Kenosha, Wis.
Branches and Distributing Agencies: Chicago, Milwaukee, Boston, Cleveland, New York, San Francisco.
Representatives in all the leading cities.

THE CAR OF STEADY SERVICE

Your courtesy in mentioning the Magazine when writing will be appreciated

WE PRINT THIS MAGAZINE

JUDD & DETWEILER, Inc.

PRINTERS

of BOOKS, CATALOGS
Etc. ¶ A SPECIALTY *of*
BRIEFS *and* RECORDS

420-422 Eleventh St. N. W.

WASHINGTON, D. C.

OUT-OF-TOWN WORK SOLICITED

Hotel Martinique

Broadway and 33d Street
NEW YORK

"A Hotel in the Heart of Things"

¶ Pre-eminent among New York Hotels for the excellence of its Cuisine, Service, and Appointment. Highest Standard of Accommodations at Moderate Rates.

CHAS. LEIGH TAYLOR, Pres't
WALTER S. GILSON, V.-Pres't
P. L. PINKERTON, Manager

Also Proprietors St. Denis Hotel, New York

SPRATT'S DOG CAKES

Are the Best and Cheapest

Send for FREE Catalogue, "Dog Culture," which contains practical chapters on the feeding, kenneling, and general management of dogs; also chapters on cats.

SPRATT'S PATENT
(Am.) Ltd.

Newark, N. J.
San Francisco, Cal.
Boston, Mass.
St. Louis, Mo.
Cleveland, Ohio
Montreal, Can.

GRAPES, from their most healthful properties, give ROYAL its active and principal ingredient

ROYAL
Baking Powder
Absolutely Pure

It is economy to use Royal Baking Powder. It saves labor, health and money.

Where the best food is required no other baking powder or leavening agent can take the place or do the work of Royal Baking Powder.

SEND FOR A COOK BOOK FOR CAMPING

Address: Adv. Dept. Royal Baking Powder Co., New York City

THE

WASHINGTON LOAN AND TRUST COMPANY

WASHINGTON, D. C.

CAPITAL	$1,000,000.00
SURPLUS AND PROFITS, OVER	$850,000.00

CHARTERED BY CONGRESS OF U. S. AND UNDER THE SUPERVISION OF THE COMPTROLLER OF THE CURRENCY

SOLICITS OUT OF TOWN ACCOUNTS AND PAYS INTEREST ON ALL DEPOSITS

ACTS AS EXECUTOR AND TRUSTEE UNDER WILL AND IN ALL FIDUCIARY CAPACITIES

BUYS AND SELLS FOREIGN EXCHANGE

JOHN JOY EDSON,
PRESIDENT

PRESS OF JUDD & DETWEILER, INC., WASHINGTON, D. C.